From: Ady Milos
To: Julie Cozzi
Subject: 26 Mile Noise Study Comments
Date: Friday, June 19, 2015 10:48:05 AM

Julie,
I am glad this study was done. We now know, with scientific evidence, what most of us out here have thought all along. That Ms. Platchta's complaints are much to do about nothing. I live in the area the study designates as Site 4, "Neighboring Estate", alongside Site 3, "Roadway". I can barely hear the helicopters. Residents Jessica Platchta and her partner, Nicholas Szatkowski live farther into the "Neighboring Estate"; nowhere near testing Site 4, farther away than I am.

While I am glad for the study (and pleased that the Borough is asking for a dismissal), I am enraged that we Borough residents have to pay to defend such a frivolous claim. The Borough could be using the money used to defend this suit to FIX THE DAMNED CHILKAT LAKE ROAD! One would think the claimants would spend their energies on something much more worthwhile and necessary for the neighborhood (not to mention our vehicles' shocks!). They'd certainly get more support from their neighbors!

Maybe someone should explain to the claimants that Frivolous lawsuits are defined as "those filed by a party or attorney who is aware they are without merit, because of a lack of supporting legal argument or factual basis for the claims. Frivolous lawsuits waste time, money, and judicial resources, *and fines and/or sanctions may be imposed upon a party or their attorney for filing such a claim."*

Just sayin'.....

Thanks for the opportunity to comment,

Ady Milos

From: Ady Milos
To: Julie Cozzi
Subject: Correction to my noise study comments
Date: Friday, June 19, 2015 4:22:30 PM

Julie,
I was mistaken with my assertion that I lived near Site 4. Looking more closely at the aerial image, I realize I am actually located south of Site 3. Ms. Platchta resides southeast of Site 3.

Please attach this correction to my previous comments, with my apologies.

Thank you,
Ady Milos

From:	Weishahn
To:	Julie Cozzi
Cc:	David Sosa; Janhill; Dave Berry; George Campbell; Thecases; Joanne Waterman; Diana Lapham; Ron Jackson
Subject:	Comments on Helicopter Noise Study
Date:	Friday, June 26, 2015 4:21:30 PM
Attachments:	Helicopter Noise Study, Comments, 6-26-15.docx

Hello Julie,

Please find my comments on the draft helicopter noise study attached.

Thank you,

Carolyn Weishahn

June 26, 2015

Comments re the Helicopter Noise Study

Due to the highly technical nature of this report, I suggest that after the study consultants present the webcast as described in "Task 4 -- Presentation of Results" of the study contract, the borough have another comment period. There are bound to be further comments in response to the webcast.

There are several things to keep in mind about this noise study.

First, the study often uses the 65 DNL metric, however it clearly states that the site DNLs can't be directly compared to the FAA 65 DNL significance threshold:

For this Study, the measured DNL from the sites above cannot be directly compared to the 65 DNL significance threshold because the annual average was not modeled using Integrated Noise Model. However, the measured average levels at the three sites during the study period (outside of the helipad itself) are generally below what measurements would be expected at the significant 65 DNL or higher level.

Second, even if the study had modeled an annual DNL average using the Integrated Noise Model, the FAA make it clear that the 65 DNL threshold for residential land use is not intended to substitute federal guidelines for local planning for noise compatible land uses. In other words, while the feds use one set of guidelines, each local community determines its own noise compatible land uses.

http://www.faa.gov/airports/environmental/environmental_desk_ref/media/desk_ref_chap17.pdf

14 CFR Part 150 land use compatibility guidelines. FAA established land use compatibility guidelines relative to certain DNL noise levels in 14 Code of Federal Regulations (CFR) Part 150. Chapter 5, Table 1 of this Desk Reference provides a copy of the Part 150 Land Use Compatibility guidelines.
(1) Different local land use compatibility standards. Although residential land uses are considered compatible with noise exposure levels below DNL 65 dB under 14 CFR Part 150:

"The responsibility for determining the acceptable and permissible land uses …rests with the local authorities...Part 150 is not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses. " -14 CFR Part 150, Table 1.

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This study uses the A-weighting scale (dBA) which does not completely characterize helicopter sound. Since the A-weighting scale eliminates low and high frequency sounds, the FAA has questioned its use for assessing helicopter sound which has a low-frequency component. As the
~~~~~~~~~~~~~~~~~~~~~~~~

FAA points out in the document below, another weighting scale, the C-weighting scale, is useful for measuring wall vibration energies that can occur from helicopter noise.

http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/media/04nov-30-rtc.pdf

3.5.3 Is A-weighting the optimum weighting for assessing helicopter sound?
As discussed above, there is some evidence that the A-weighting metric may not fully characterize human reactions to noise events with substantial low-frequency content.

……………………………….

The C-weighting has been used in the United States for almost 30 years to assess blast noise and sonic booms in order to account for the noise-induced rattles generated by these sounds, and currently, several other countries also use the C-weighting for this purpose. It is primarily the sound energies in the 10 to 30 Hz ranges that induce wall vibrations. The C-weighting could be used to identify those helicopter sound energies that will induce wall vibrations.

……………………………

Helicopters, with their distinctive sound character, appeared to be more noticeable than other sounds for the same A-weighted sound exposure level.

……………………………..

As discussed in "effects on individuals" (Section 3), there are multiple noise metrics utilized to assess noise (EPNL, ASEL, DNL, etc). However, civil helicopter annoyance assessments utilize the same acoustic methodology adopted for airplanes with no distinction for helicopter's unique noise character. **As a result, the annoyance of unaccustomed, impulsive helicopter noise has not been fully substantiated by a well-correlated metric. The FAA favors the chartering a technical effort to focus on low-frequency noise metric to evaluate helicopter annoyance.** (emphasis added)

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Another sound component of helicopter noise that this study does not include is helicopter 'blade slap.'

One issue that this study does confirm is that the neighborhood where SEABA wants to put a heliport is a **very quiet neighborhood.** (at L90, dBA measures at the 4 sites: 21.8, 29.9,17.5, and 16.9)

Another issue is that while SEABA reported 4 heliski user days for March 9, data was collected on other days as well during the study. Were these helicopter flights taken while "fully loaded" as required by the study contract? Were the landings and take-off made in compliance with permit flight requirements to obtain elevation as quickly as possible? Residents have reported that the flights were conducted at very low elevations.
~~~~~~

I feel that the use of this study as a basis for changing the way the borough assesses heliport impacts in any particular neighborhood is not appropriate due to the lack of confidence in DNL when evaluating helicopter noise and the incomplete nature of calculating the DNL in this study.

Please notify me when the webcast by the contracted company will be available. Again, I feel another comment period is necessary after the public has had a chance to view the webcast.

Sincerely,

Carolyn Weishahn

From:	Weishahn
To:	David Sosa
Cc:	Julie Cozzi
Subject:	Re: Noise Study Contract
Date:	Monday, June 22, 2015 1:46:28 PM
Attachments:	doc10760520150619171917.pdf

Hello David,

I notice in the noise study report that Task 4, Presentations of Results, will be accomplished by a Webcast. Do you know when that will occur? Will it be interactive so that questions may be asked during the Webcast? Will it be available to the public as well as borough officials?

Thank you for checking on this part of the noise study process.

Cary Weishahn

On 2015-06-19 16:03, David Sosa wrote:

> Documents as requested
>
> -----Original Message-----
> From: System Administrator
> Sent: Friday, June 19, 2015 4:19 PM
> To: David Sosa
> Subject: Scan from AdminKyocera
>
> ----------
> Taskalfa 5500i
> ----------

From:	Derek Poinsette
To:	Julie Cozzi; Ron Jackson; Joanne Waterman; Mike Case; Jan Hill; George Campbell; Diana Lapham; Dave Berry; David Sosa
Cc:	sunny@seaba-heli.com
Subject:	Helicopter Noise Study
Date:	Saturday, June 20, 2015 10:53:26 AM

Haines Borough Assembly and Administration:

I live on Mosquito Lake Road. I have read the results of the helicopter noise study, and I have some specific comments.

The ambient noise level of the general neighborhood was measured at ~21 dBA (L50 from Table 4-1). This is a level of sound that is less than bird song. The sound of a helicopter measured at the most DISTANT measuring location ("neighboring estate") registered at 90 dBA, equivalent to a DC-10 take-off. At the helipad iteslf, measurements exceeded 104 dBA (Lmax from Table 4-1). To the human ear, 90 dBA is 128 times louder than 20 dBA. In actuality, 90 dB is 10 million times 20 dB. That's not how it sounds to us, but it may very well sound that way to other creatures.

The study computed the ambient average daily noise level (DNL) in the neighborhood and found it to be 30 to 51 DNL, including the helicopter activity. The SEABA property came in at 69 DNL. The FAA classifies "wilderness residential" as 35 DNL. "Urban row housing on a major avenue" is 68 DNL.

So, we can conclude from this study that the addition of a heliport to the neighborhood moves the character of the place from "wilderness residential", past "rural residential", past "agricultural land", on past "wooded residential" and "old urban residential", all the way up to "urban row housing on a major avenue".

No one who has invested time, money, sweat and tears building a home up here ever thought that one day the Upper Valley was going to to have sound characteristics similar to those of downtown Chicago. My place is exactly two miles from the SEABA heliport as the crow flies (according to Google Earth). There is a small mountain between us (Ski Hill), and yet I can hear, as plain as if we were next-door neighbors, all of the helicopter activities that occur there. I don't know exactly how loud it is, but it is loud enough to be heard through hearing protection and over the noise of my wood shop equipment. And it is much louder than the DOT chip sealing that is going on right now just 3/4-mile away.

This is a very quiet place up here; unlike the lower valley, we don't even have wind noise on most days. When you add something like regular helicopter activity into this environment, it completely changes the character of the place--from wilderness to urban row housing. And now we have the numbers to prove it.

Sincerely,

Derek Poinsette
Mosquito Lake
Box 555
Haines, AK 99827
767-5414

poinsette.ak@gmail.com

CC: Scott Sundberg

From:	george figdor
To:	Julie Cozzi
Subject:	comments on helicopter noise study
Date:	Friday, June 26, 2015 4:04:29 PM

RE: Comments on 26-mile helicopter noise study

The deadline is fast approaching, so i just wanted to get these brief comments to you before that. i have read some of the research from various places in the U.S. concerning the impact of helicopter noise on local residents. Several interesting points seem to emerge in many of the studies.

1. The concern over impacts of helicopter noise is not just a local one in the Chilkat Valley. Throughout the nation, nearby resident are quite frequently opposed to helicopter activities near their homes. And generally residents are passionate about wanting to end the disturbance.

2. Helicopter noises are perceived to be noisier than their decibel reading. In other words, the unique quality of the noise makes it result in the same perceived disturbance as a noise with higher decibel reading. So, many studies argue that in some ways one can't measure the impact helicopter noise with a meter.

3. The nature of helicopter noise has been shown to have a wide range of health impacts---particularly among young children. This can include brain and emotional damage. Thus helicopter activities must be evaluated in public health terms as well as the usual parameters. And these health impacts occur even when the activity is not regular. In fact, the stress caused by unpredictable nature of certain activies often caused greater health impacts related to stress.

4. The emerging consensus seems to be that residential areas and helicopter traffic do not mix well, and that helicopter traffic is most often best located in places where people do not live---liket in commercial airport areas.

George Figdor
Box 612
Haines, AK

From:	Gretchen Roffler
To:	Julie Cozzi
Subject:	comments noise study
Date:	Friday, June 26, 2015 9:32:47 AM

Dear Ms. Cozzi and the Borough of Haines,

I appreciate that the Borough has taken into consideration the collection of sound data to help inform a decision about SEABA's proposed CUP. It appears the Mead and Hunt team have done an adequate job; however the sampling data are sparse, and likely not remotely representative of the noise that would be experience during a normal heli ski operating period.

I was dismayed by the poor interpretation of the noise data in this study. The DNL is a worthless noise metric as it unrealistically averages noise over a 24 hour period. The logic behind relying on this metric is flawed. Instead of accounting for the helicopter SEL and the number of takeoff and landing events, it actually merely washes them out over a longer period of time to devalue the numbers. Additionally, because these helicopters do not operate after civil twilight and before dawn, factoring in nighttime noise levels is a meaningless exercise. The DNL may be the FAA standard for residential noise assessment, and it might be convenient to use these values because they portray lower noise volumes, but I would hope that the Haines Borough would maintain higher standards than this.

Evaluating the values of the SEL and Lmax metrics, we can see that the noise disturbance caused by helicopters is in fact very high for all the recording sites, particularly those that are closest to the proposed heli pad, exceeding recommended levels for residential zones. These are the values that should be taken into the highest consideration, and not the 24 hour mean.

It is also important to consider that the actual time of very loud SEL and Lmax (and by default DNL) would be extended considerably during a normal heli ski day. There would be landings and takeoffs of multiple helicopters continuously throughout the day, in addition to lengthy refueling time. This study does not accurately capture this level of disturbance that would be present in a realistic operating scenario.

At the heart of the issue is promotion of one business over the residential way of life in the neighborhood. We purchased our property (adjacent to the proposed SEABA helipad) because we wanted to have a quiet place to occupy in a peaceful neighborhood. SEABA did not disclose their intention to build a helipad at the time of the land transfer. I am not opposed in any way to heli skiing (I have partaken in this activity), but I am opposed to landing helicopters in a residential neighborhood. The justification for supporting this plan by the Borough relies on faulty logic that it will promote economic development for the community. Consider that keeping heli skiers within Haines proper (at SEABA's current lodging at Ft. Seward) actually provides more of an economic pulse to businesses in the community than containing them in our neighborhood, where there is nowhere to spend money. If SEABA develops this land and builds an "all inclusive" heli ski lodge the clients will only be supporting one business, and not all of the stores and restaurants in Haines. See Cordova's Points North as an example of how to *not* create a sustainable business that benefits the greater community. This is not the model that Haines should want to follow.

I hope that you consider these comments in the decision process. There should be a way that heli skiing can flourish in Haines and benefit the majority of the community economically (not just the owners of one business) while at the same time allowing residents to maintain a peaceful way of life. Please consider creation of a helipad outside of residential neighborhoods (through land transfers or otherwise), or promotion of the multitude of heli pads that already currently exist.

Thank you for your consideration,
Gretchen Roffler

From:	Heidi Robichaud
To:	Julie Cozzi
Subject:	noise study report
Date:	Thursday, June 18, 2015 11:22:54 AM

To the Borough Clerk,

I am shocked and disappointed by not only the outrageous expenditure of borough funds on a helicopter noise study but also by the unhelpful, convoluted and almost irrelevant results of this study. The only meaningful things established by the report are that the neighborhood surrounding the proposed heliport is normally extremely quiet, and that the helicopters are really loud. (Appendix A. Sound Exposure Levels during the test period range from a (loud) low at the furthest test site of 69.5 dBA to a (painfully loud) high of 120.9 dBA at the nearest.)

Ironically, because of the way DNL was figured, the quieter the ambient noise of the neighborhood, the lower the DNL, even though the helicopter noise remains at the same level, very loud. A 2011 FAA technical report contained the following caution, "DNL has another major practical limitation. It doesn't work particularly well as a predictor of aircraft noise impacts."

Using DNL as its justification, the Haines Noise Report asserts that if you take a very quiet place and add a very loud noise for a relatively short period of time, you get a moderately quiet place, when actually, what you get is a very quiet place with a very loud thing in it. If someone bonks you on the head really hard in the morning, and then refrains from bonking your head for the rest of the day, did they actually just touch you gently the whole time? Obviously not.

Additionally, the study did not test the noise levels during regular operations that would include easily 90 landings or even more (2 helis per day, all day, times 6 days). So the average sound (DNL) would have been be enormously higher had a realistic scenario been studied. We should find it disturbing that professional sound consultants we paid about $45,000, would make conclusions about the appropriateness of a particular development under conditions like this, where they clearly don't have measurements reflecting the actual level of use likely to occur with the establishment of a heliport there.

Even with the dampening effects of A-weighting, the noise levels measured ranged from 77.4 to 104.3 dBA. All of these noise levels are above reference ranges for

residential noise standards, standards preserving healthy hearing, and national and international standards protecting public health. (See Anchorage municipal codes, EPA Noise Control Act of 1972, and World Health Organization Guidelines for Community Noise.)

I urge the borough to file this report, write off the outrageous expenditure and listen to the concerns of the residents of the area.

Most respectfully,

Heidi Robichaud

From:	Carol Tuynman
To:	David Sosa
Cc:	Julie Cozzi
Subject:	Noise Study comments due June 26, 2015
Date:	Friday, June 26, 2015 3:59:20 PM

Dear David,

I am submitting comments as the creative director of Alaska Arts Confluence. My comments are in reference to the cultural norms and social/political background related to helicopter presence in Haines.

Before the 26 Mile heliport was permitted, there was general consensus that the airport is the appropriate location for helicopter take off and landing and that a heliport at 26 Mile would become a noise issue for residents in that area. Despite knowledge of this problem and considerable public objection from people outside of the study area, the heliport was permitted and went into operation. The Borough's unwillingness to find a resolution of the helipad location that would satisfactorily address the public concern has led to the challenge to the 26 Mile helipad.

The study uses standards and assumptions generally not appropriate to the Chilkat Valley. The level of noise people become accustomed to is a factor of conditioning. For example, the noise created by chainsaws is an accepted part of our culture. Chainsaws are used to cut down trees to provide firewood necessary for heating many of our homes. People here accept higher noise levels that relate to our daily lives. A number of years past the Haines Borough voted not to allow helicopter sightseeing tours during the summer tourism season when they saw how intrusive and disruptive the helicopter tours were in Juneau. Helicopter flights for hell skiing by the existing tour operators would be acceptable and appropriate if they used the airport and stayed within the designated flight paths.

We value our natural environment and the general quiet of a rural community. Although it is a small number of people who are negatively affected by the helicopter paths evaluated in the study, those residents should have the benefit of the same protection from helicopter noise that was established by the Borough.

The noise study, though scientific by FAA standards for the rest of the country is not appropriate for the Haines Borough. Regularly scheduled airplanes and helicopters should originate only from the Haines Airport, where the noise levels of helicopters would be totally within acceptable noise levels.

Please enter my comments into the record for public comment on the Noise Study, 2015.

Sincerely,
Carol Tuynman
Creative Director
Alaska Arts Confluence
Post Office Box 1664
Haines, Alaska 99827
907.303.0222

From:	bearded pigeon
To:	Julie Cozzi
Subject:	noise report comment
Date:	Friday, June 26, 2015 3:56:04 PM

I am a resident in the area of the SEABA noise report. I find the data in this report inconclusive and more data would need to be recorded to get a full understanding of the noise levels in the area. I also find this study a political tool for the validation of one companies agenda. if any laws are passed or permits given based on the data in this report it would be insulting to those that would like to continue to live and enjoy a quiet existence.
Thanks for hearing my comment,
Josh Grimm

From:	John Norton
To:	Julie Cozzi
Subject:	Fw: Noise Study comments
Date:	Friday, June 26, 2015 6:31:24 PM
Attachments:	wlEmoticon-smile[1].png Helicopter noise study 2015.doc

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From: John Norton
Sent: Friday, June 26, 2015 11:17 AM
To: jcossi@haines.ak.us
Subject: Noise Study comments

Hi Julie, Finally; a rainy day so I can get some correspondence taken care of  . I've attached a few comments regarding the Noise Study that I'd appreciate you forwarding to the appropriate staff. Cheers, John Norton

Borough Staff and Assembly Members,

Thank you for the extended comment period of the 2015 Noise Study. I believe that the Lmax measurements are the most important metric in the discussion of allowing the development of a heliport in the Chilkat Lake Road area. The Lmax represents the loudest sound experienced during an event and in my opinion should form the foundation for deciding the impact of noise in that area. If my reading of that document is correct it appears that noise levels of 90dBA or greater occurred during helicopter flights in the monitored area.. These noise levels are categorized as "Very Loud" and I believe that this metric is key to understanding the concerns that the local homeowners have brought to the Borough. I am in agreement that this level of aircraft noise, in an area that is attractive to residential homeowners due to it's quiet, rural character, is inappropriate.

I agree with comments made by others that the DNL metric is not helpful in this discussion as the DNL averages over a 24 hour period a small number of loud events within an area that is normally very quiet. This is especially inappropriate where darkness precludes aircraft flights to less than half of that 24 hour period. To use the DNL figures to base ones decision would misapply that metric which is more appropriately applied to noise from a busy freeway, industrial site or large airport. An analogy would be to average the fatal burns received in the flash fire from fuel thrown into the woodstove with the pleasant warmth of the slowly burning fire over 24 hours. It is the single event that is useful in guiding our behavior, not the averaged data.

To conclude, I would like to suggest that the appropriate staff and Assembly members take a few minutes to experience 90+dBA sound levels during discussion of this issue. It may be as simple as bringing a boom-box into the assembly chambers and turing the volume to full . That simple exercise would be very helpful in understanding why local homeowners are so opposed to the development of a heliport near their homes. Thank you for your consideration.

Regards, John Norton
Haines, AK

From:	Joe Ordonez
To:	Julie Cozzi
Subject:	comments on noise study
Date:	Thursday, June 25, 2015 10:15:25 PM

Greetings,

I have looked over the noise study. It was rather technical and not easy reading for me. I have a college degree, and I'm not sure what percentage of our community has post-secondary education. Perhaps in the future, when the Borough hires an outside firm to perform a technical study, part of the contract should be for the firm to host a public presentation where they explain the methodology and the results. An informed public should be the goal.

One thing I noticed is that the noise study indicates that the ambient noise level is at the low end of the scale for a 'wooded area." That is what people live there and who moved there are used to, and have come to expect. Even with the helicopter activity, the average noise level was low. With an average of 51 being the norm for wooded areas, and the noise level in the study area being 30-51, this tells me that this is a quiet neighborhood. So introducing a noisy activity into that type of environment would be particularly intrusive.

Also, to use averaging to try to describe the impact of noise events is misleading. One serious noise event can ruin some people's entire day, and setting up a helipad with multiple take-offs and landing on a daily basis is sure to change the character of the neighborhood. And the study was only for 9 "operations" over a six-day period. How does this compare to the number of "operations" allowed if this was to become a true base of operations for SEABA and how would that compare with the data collected? I do not see that information in the study but it is a critical piece of information. Was it included somewhere but I missed it?

I also note that they have said there is no "noise standard" for the Haines Borough. Without setting a standard, there is no way to decide whether or not this noise level is excessive. For us to accept the FAA standard without public discussion and involvement would not be fair nor wise. We have a history of preferring to make our own decision as a community when possible, rather than allowing the federal government to decide what our standards should be.

The reason conditional use permits were required and strict criteria set in place for helicopter landing pads is because helicopter activity can have a profound negative affect on local residents. Putting a helicopter pad in a quiet area is not a good idea. We have an airport for noisy air activity, and that is one of the designated landing places for helicopters. There are three other dedicated areas for helicopter use.....the airport, 18 mile and 33 mile. I also understand that helicopters are taking off from the Big Nugget mine in Porcupine, even though it is not one of the designated areas but has been somehow "grandfathered" in.
These are places that people moving into the area can expect will have helicopter noise and activity.

I am worried about the precedent that allowing a helicopter pad in a quiet neighborhood will set. If the conclusions gleaned from this study are that helicopter noise is a "nonissue, ' as one of our Assembly members was quoted in the CVN, what is to stop helipads from turning up all over the Borough? Certainly it makes

sense from the economic standpoint of a helicopter tour operator to have their lodge and heliport on their private property. There are presently three helicopter ski companies in Haines, and no limit on the potential number of companies allowed to operate. If SEABA gets permission to put a helipad at their lodge, they will have a competitive advantage over the other two operators. The logical next step will be for the other two operators to build helipads on their private property and so we will have more helipads in the Borough. The original intent of requiring a conditional use permit for helipads was to limit their proliferation in the borough and contain their growth. Certainly, there is some point where we would have too many heliports in our valley. Many of our citizens believe we have already reached that point.

I am also concerned about SEABA's involvement with the study. SEABA has a documented history of not following rules that they have agreed upon. How do we know that they followed the rules for this study? How much of the information for this study was provided by them and how do we know if it is accurate? How do we know that they will follow the rules in the future? How many Borough resources will need to be utilized to keep track of whether or not they are following the rules, and what sort of penalties will they received when/if they are caught breaking the rules? And will these penalties be serious enough to ensure that they follow the rules in the future? These are serious questions which I have been asking since I was on the Helicopter Advisory committee in 2011 and they have never been adequately addressed.

Another serious concern I have is the allegation that the flights used in the study were flown at an elevation of 200 feet above ground level. It says in the newspaper that these allegations were dismissed as "unsubstantiated.' I would hope that there is accurate GPS data from the 9 flight operations that took place during the study. If this information was not recorded or is not available to the public, then the results of the study are at best, inconclusive, and, at worst, seriously flawed. For what we paid, I would think that the citizens have a right to know if this allegation is true or not. The elevation of the flight has a significant effect on the noise signature.

I am open-minded and hope to hear more from the Borough about the study and how the results planned to be used. I recommend that we consider this study preliminary and proceed with extreme caution before we base any sort of planning or policy decisions on this dubious exercise.

Sincerely and thanks,

Joe Ordonez

--

Joe Ordonez
Rainbow Glacier Adventures LLC
P.O. Box 1103
Haines, Alaska 99827
Phone: 907-766-3576
Fax: 907-766-3580
joe@joeordonez.com
www.tourhaines.com

From:	Joy and Pete Paquet
To:	Julie Cozzi
Cc:	Joy and Pete Paquet
Subject:	Attention Borough Clerk, Re: Comments Regarding Haines Noise Study Report
Date:	Friday, June 19, 2015 7:09:05 AM

To: Haines Borough

Did we really need to spend 52K to conclude Helicopters are loud on both take-offs and landings? How much taxpayer money is still being spent on Borough Attorney fees defending a Conditional Use permit appeal?

The Plaintiff in the CUP appeal has more expertise and knowledge , of what the base noise level of the Chilkat Lake Road area is than the FAA? Interesting.

This isn't about noise or Helicopters, Heli-Pads, or a Ski Lodge. Nor is this about the lovely quiet rural life style some of us have here.

This is about a couple of people trying to force their life style choices on their peaceful , hard working and quiet neighbors, and it will never stop. They will never be happy, or satisfied until we all live under a pile of brush. More frivolous lawsuits, more petitions , more complaint forms. More time spent from the Assembly to the Planning Commission, and the Borough staff wasting countless hours, defending itself.

Thanks for the opportunity to comment on this
Regards,

Maria Paquet,
Eagle Bluff Drive

From:	Jessica Meadow
To:	Julie Cozzi; Nicholas Szatkowski
Subject:	Noise Comments
Date:	Friday, June 26, 2015 3:34:25 PM
Attachments:	PlachtaNoiseComments2015.pdf

Hi Julie,

My comments on the Draft Haines Noise Report are attached.

Thanks,

Jessica Plachta

Comments re. Draft Haines Noise Report 2014

Jesssica Plachta
HC 60 Box 2621
Haines, AK 99827
jessica.meadow@gmail.com

While there are a few useful data sets contained within the Draft Haines Noise Report, its assumptions, methodology and conclusions are mostly problematic to the point of being inoperable. Some of these problems are not the fault of Mead and Hunt, but derive from the actions of the commercial heliski operator, Southeast Alaska Backcountry Adventures, (SEABA). Some of the problems derive from the difficulties inherent in attempting to apply an urban (public airport) equation to a rural (wilderness residential) setting. And still others of the problems may derive from factors unknown to this commenter.

Problems with Methodology:

Insufficient Data

Nine flights is an overwhelmingly insufficient amount of data from which to draw conclusions, especially since--according to SEABA's biweekly flight operations report-- the 4 flights on the first day of the study were the only flights that were actually part of their commercial tour operations. Nine flights over the course of seven days are being used to calculate the expected impacts of a heliport at the site. The data has been misused. What should be calculated is the sonic impact of two to four helicopters using the site constantly from the hours of 8 am to 6 pm, for three months. With that amount of use, the sound of helicopters almost never goes away.

Inaccurate Data

Even the data recorded from the nine flights aren't representative of lawful commercial tour operations from the site. SEABA was observed consistently and dramatically violating their flight rules, by skimming the treetops between the CUPLZ and mountaintops. This further skewed the results of the noise study by altering the profile and duration of each helicopter noise event. Sound Exposure Levels, LEQs, and DNLs are all highly related to the duration of noise events. SEABA's unlawful flight behavior corrupted the results of the study by artificially curtailing the duration and intensity of noise detected by the measuring devices.

Missing "Raw" Data, 1/3 Octave Data

The contract Mead and Hunt signed with the Haines Borough says that they will "include unweighted, "raw" sound data measured in decibels." The Draft Report includes only A-weighted (dB(A)) sound data. The official contract between Mead and Hunt and the Haines Borough also specified that they would include "1/3 octave sound level measurements at each location from which noise levels are measured and such ratings will be included in a standard sound measurement report." Presumably, the 1/3 octave sound measurements would show us what frequencies are emitted by the helicopter, and what percentage of the total noise is low-frequency noise. This information might be useful, but has not been provided by the Consultant. Mead and Hunt contracted to prepare the following metrics: DNL, SEL, LMAX, and Time Above," using the FAA's Integrated Noise Model. This also was not done.

Omitting the raw, unweighted data might be considered an breach of contract with the citizens of the Haines Borough, who payed for the Noise Study. Omitting the raw data is especially egregious when Mead and Hunt acknowledge that A-weighting carves off as much as 50 decibels from the decibel number of low-frequency sounds, because its purpose is to de-emphasize the impact of low-frequency sound. Helicopters obviously make abundant low frequency sound. The World Health Organization says that low-frequency sound emitters should be effectively penalized for their additional health and annoyance effects by adding decibels, not subtracting them.

Low frequency sound has particular effects on structures, human health and stress disorders, birds and wildlife, and has even been developed into a tool for fighting fire. Low frequency noise, aimed at the base of a fire, can extinguish the flame. Conducting a noise study which specifically excludes measuring the particular effects of low frequency sound, when assessing the impacts of a low frequency noise emitter like a helicopter, is

simply inadequate, ultimately misleading, and cannot be considered authoritative.

Problems with Assumptions/Sources for Information:

The Draft Noise Report claims that, "There are no local noise standards in effect, so in comparison, the only federal standard for noise and land use compatibility is from the Federal Aviation Administration. This standard is based on the DNL, which identifies the acceptability of various types of land use with aircraft noise exposure. Under this standard:
[¥] Residential uses are compatible with noise up to 65 DNL and up to 70 DNL with sound insulation; "

In fact, "**The FAA does not regulate aircraft noise**," according to Ian Gregor, the public affairs manager for the Pacific region of the FAA. "If a noise complaint involved an allegation that an aircraft was flying improperly low or unsafely, we would investigate the safety component of that complaint." Furthermore, the FAA plays absolutely no role in local planning decisions regarding questions of compatibility with residential uses. The 65DNL standard is an averaged noise level that the FAA believes is compatible with areas surrounding urban airports, and has no relevance whatsoever in rural Alaska. Mead and Hunt's suggestion that this would be an appropriate standard here undermines their credibility and professionalism, and begs the question, "Are they impartially gathering data, or are they preparing a report to suit the boss?"

Meanwhile, there are **other federal agencies that have generated standards for noise** and land use compatibility, such as the EPA, which is charged with protecting public health. Congress adopted the **Noise Control Act of 1972**, which set out much stricter guidelines than those recommended by the FAA. This federal law indicates for rural residential areas a standard of 35-45 dB.

Mead and Hunt could have looked closer to home for guidance. Other municipalities in Alaska do have noise regulations. The **city of Anchorage has noise regulations** prohibiting noise of 60 dB or greater from crossing residential property lines. Allowing a heliport at this site would regularly submit the nearest neighbors to sonic impacts that are more than 100 times greater than those allowed in urban Anchorage! Obviously, this constitutes "undue noise."

The city of Los Angeles has even more protective noise regulations. In residential areas of that city, sounds above 50 dB during day and 45 dB during night are unlawful. The more than 100 private properties within the mile radius around SEABA's heliport would be subjected to sound levels between 50 and 100 decibels--all levels that would be unlawful in urban Los Angeles.

Let's remember now that **70 dB is 10 times louder than 60 dB, and that 80 dB is 100 times louder. 100 dB is 1000 times louder than 70 decibels**, while 70 dB will already cause hearing loss. No one should be subjected to that kind of noise in their own homes, on their own private properties, against their will, and for no appreciable benefit.

In 1979, the **EPA's "Noise Effects Handbook"** implicated noise in a number of health problems, including strokes, ulcers, heart disease and high blood pressure, as well as other stress-related disorders and mental health issues. International health organizations have recognized extensive effects of noise on human health. The **World Health Organization** has determined that, besides hearing loss, noise can cause loss of concentration, cognitive and behavioral problems, and stress disorders, especially in children and other sensitive populations.

Problems with Conclusions:

DNL:
Mead and Hunt erroneously diluted (via misapplication of DNL metrics) the extremely loud helicopter noise impact with the ambient neighborhood quiet, rather than merely impartially reporting the contrast, as they should

have done.

"Undue Noise:"
Haines Borough law instructs the PC to determine whether a CUP applicant has proven an absence of undue noise on neighboring properties. No part of the HBC suggests that an "average" (more accurately a dilution) of impacts at locations arbitrarily chosen by Borough administration can be used as a substitute for the standards outlined in HBC.

It is the job of the Haines Borough Planning Commission and affected citizens to determine whether the noise is "undue," not the job of a hired consultant. It seems inappropriate for a technical sound consultant to draw conclusions regarding what level of noise impact should be considered acceptable in a community. Furthermore, Hunt et. al.'s suggestion that the FAA's standard of 65 decibels for communities surrounding (primarily urban) airports should be applied in a quiet residential area in rural Alaska is downright ludicrous.

Useful Components of the Noise Report:

Despite the significant problems marring the usability of the Haines Noise Report, there are some refreshingly simple truths reflected therein. One, the background noise in **the neighborhood is inarguably quiet.** Quieter than any category available in the Consultant's charts. This simple fact should lay to rest forever the false assertion that this neighborhood is somehow a pre-existing industrial area that is already so loud that helicopters won't be noticed above the din of all the other industrial activities. There are, in fact, no other industrial activities in the neighborhood. The other undeniable fact is that **helicopters are extremely loud**; represented in the Noise Study by the Lmax numbers. Despite the reduction imposed by A-weighting, the numbers show that **the heliport would not be allowed** in any municipality that has noise regulations, nor would it be allowed by national or international regulatory bodies. The development of a heavy industrial activity like a commercial heliport is not compatible with a "wilderness residential" area, and is not excused in any way by the $42,000 spent on this report. The Haines Borough should make a note to listen to its citizens next time a question like this comes up, and save itself some dough.

Conclusion:

Haines Borough Code 18.30.010 specifies under "Finding," "A permit approval shall include a written finding that the proposed use can occur consistent with the comprehensive plan, harmoniously with other activities allowed in the zone and **will not disrupt the character of the neighborhood."**

Regardless of how much of the taxpayer's money the Haines Borough spends on outside studies, the proposed use **cannot comply with Borough code**. A heliport in this neighborhood is not consistent with the Comprehensive Plan, it cannot coexist harmoniously with other activities allowed in this zone, and it will absolutely disrupt the character of the neighborhood. The heliport was unlawfully allowed by the Haines Borough Assembly, and unlawfully operated by SEABA. This is why there has been **consistent, vigorous, widespread opposition to allowing the heliport**, and there will continue to be opposition until the issue is put to rest.

From:	Kip Kermoian
To:	David Sosa
Cc:	Julie Cozzi
Subject:	Draft Haines Noise Study comments
Date:	Friday, June 26, 2015 4:15:42 PM
Attachments:	K. Kermoian draft Haines Noise Study comments 62615.doc

Dr. Mr. Sosa,

Please find my comments regarding the Draft Haines Noise Study comments attached.

Thank you,

Kip

Kip Kermoian
PO Box 1024
Haines, AK
99827

June, 26, 2015

Mr. D. Sosa
Manager
Haines Borough

Re: Helicopter noise study

Dear Mr. Sosa,

I am assuming that you feel strongly about the integrity of all of those serving in the borough while conducting borough business and support the precept that personal biases should be put aside when, in this instance, a scientific study has been commissioned to objectively assess impacts to residents living adjacent to the proposed helicopter operation at .6 mile Chilkat Lake Rd. It is, after all, what each of us rely upon if a democracy is to function effectively.

If my above assertion is accurate, the results of the noise study do not accurately reflect their intended purpose, but rather, serve to support an obvious bias.

Who in the borough administration responded to Jessica Plachta and Nicholas Szatkowski's confirmed allegation - using GPS data of the helicopter test flights – that the helicopters were "flying at less than 200 feet above ground level during most of the 16-mile roundtrip between the helipad and a drop-off point." (Source: Chilkat Valley News, Thursday, June 18, 2015), which is contrary to the borough's flight operation agreement requiring helicopters to "attain as quickly as practicable after takeoff and maintain a minimum elevation of 1,500 feet above ground level while in flight", characterizing their concern as "unsubstantiated allegations"?

If the GPS data is confirmed to be accurate, this assessment by the borough administration mitigates the purpose of the noise study and casts doubt on not only the findings, as the results do not accurately reflect noise levels should helicopters abide by the borough's agreed upon flight standards, but raises the question of unethical bias within the borough administration.

To base any assessment of the impacts of this impending noise upon residents that will permanently and negatively impact the quality of their lives, on a manipulated methodology, only serves to disenfranchise all those who have contributed to this process is good faith.

I hope that you will conduct a fair assessment of the methodology, and insist that only an accurate measure of real impacts be used to support a position on this issue by the borough.

Sincerely,
Kip Kermoian

From:	Kathleen Menke
To:	Julie Cozzi
Subject:	Comments on Noise Study Report
Date:	Tuesday, June 23, 2015 9:38:00 AM

Regarding the Borough's noise study report:

Grade: F

The Borough lost its way when public officials who are supposed to serve the folks who live here decided to ignore those very people they have sworn to serve.

A midnight reconsideration of a vote after the public had left a Borough meeting?

Stating that public comments on the rezoning for of a residential neighborhood for a commercial heliport were not given "much consideration"?

By making back-room deals with any business entity that walks in the manager's door while treating the general public as if their comments do not matter?

By spending thousands to "justify" a poor decision with a meaningless report?

By thinking that a measurement of decibels has anything to do with the constant intrusion that a heliport represents over others living within a neighborhood?

The Borough would be just as wise to do a decibel study on a tent full of mosquitoes, rather than ask those in the tent whether or not the mosquitoes were interfering with the peace and quiet of their lives.

Borough public officials need to take a giant step backwoods and remember the public that they have sworn to serve. Develop of system whereby folks can listen to each other and share ideas before plunging forward with plans that do not have community support.

It will take some practice, but we can do it..listen to each other and work together toward common goals and a healthy, sustainable community that serves all its residents.

Regards, Kathleen Menke

From:	lauren
To:	Julie Cozzi
Subject:	Comments on the Haines Noise Report
Date:	Friday, June 26, 2015 3:31:57 PM

Hello,

I have just read the results of the noise report and deem it somewhat irrelevant to the decision at hand; whether or not to grant SEABA permission to use their property as a heliport. Helicopters are loud, obnoxiously loud. This report hints at this when discussing the single noise events i.e. SEL and Lmax, but really misses the mark when using the DEL metrics to measure an average noise increase over a 24 hour period. You can not average a noise, especially a loud relatively short noise over a 24 hour period. It doesn't make sense to me and I consider the findings here a moot point, a very expensive moot point in my opinion. The numbers here are based on nine flights over 5 days. Even if one were to use the DEL metric system the results here do not indicate a normal day of flying for SEABA. I have heard, that at least 9 (that is the whole data set for a week used in this report) flights would leave and return to the SEABA property per day. The average or DNL is not only the wrong metrics to be using to determine if helicopters are annoying and disruptive, but the results were created based on low number of flights per day which is also does not accurately reflect what will occur here.

Another point I would like to note is we are using federal averages to as a baseline comparison however we, as residents of a small community in rural Alaska are in no way close to being comparable to federal regulations. It seems to me that most live here, especially out the highway, to be as far away from the normal standards of living especially to those living in the lower 48. I understand the federal averages are being used for lack of anything better, but do they accurately reflect the reality of living at 26 mile? I would not think so.

As a resident and property owner in the proposed heliport neighborhood, I do not want to be hearing a helicopters two months out of the year- a especially quiet and peaceful time of the year. Aside from myself and my neighborhood, I would strongly urge you to question whether this is a good move for our community as a whole. Granting things such as this heliport in our residential neighborhood will create hostile feelings towards our seasonal visitors. This I gaurentee. There are other places already in use as heli-ports that are not in the middle of neighborhoods. Why not use those? Would you permit this activity to happen in town? It is already louder there, perhaps no one would notice? I would guess not.

Thank you for your time and patience dealing with such a heated issue.
Lauren McPhun

From:	Nancy Berland
To:	Julie Cozzi
Subject:	Noise study comments
Date:	Friday, June 26, 2015 9:09:09 AM
Attachments:	NBHeliNoiseComments.doc Effects of Airport Noise on Housing Value.doc

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Julie, please accept these comments.

Thanks.

Nancy

In looking over the Noise Study and looking at the cited FAR Part 150, it's apparent that the contractor used a methodology designed for different circumstances. Basically the Noise Study concluded that the DNL measured at 4 Haines sites met the FAR Part 150 acceptable noise "standard" for residential areas near airports, with a DNL less than 65 dBA.

That FAR Part 150 applies to **existing airports** is extremely clear: it "is the primary Federal regulation guiding and controlling planning for aviation noise compatibility **on and around airports**." (Emphasis added.) The 26 Mile site is not an airport. Airports have more than 9 noise events over a 7-day period. All the fancy colored charts, graphs and tables generated by these 9 noise events and presented in the Haines study have no context, and are absolutely meaningless.

DNL is the average sound pressure level in A-weighted decibels for an average day of the year. According to FAR Part 150, this methodology works for assessing airport noise because it takes into account the effects of intensity, duration, frequency, and time of occurrence of aviation noise events, as measured against the background noise of the area. This average is used to determine compatibility at existing airports operating 365 days per year, and often 24 hours a day. Obviously there are many aviation noise events to be averaged at airports, and this is a way of ascertaining how much additional noise is created by the airport. However, the DNL for the Haines study includes only 9 noise events, that lasted a maximum total of 38 minutes (at the non-helipad sites) over a 7 day period. The impact of these 9 events becomes totally diluted in the calculated DNL by the low background noise levels at these sites for the rest of the 144 hours of the study. In other words, the DNL calculated for these sites consists of 99.66% background noise and .44% helicopter noise. What the charts and graphs really show is that this is a quiet, rural residential neighborhood that will be greatly impacted by allowing a heliport there.

Of more significance is the information (Figure 2-2) that an increase of 10 dB is humanly perceived as being twice as loud, an increase of 20 dB is perceived as 4 times as loud, an increase of 30 dB is perceived as 8 times as loud, an increase of 40 dB is perceived as 16 times as loud and an increase of 50 dB is perceived as 32 times as loud, and so on. Table 4-1 shows ambient noise levels are between 17 and 30 dBA 90% of the time, with noise events ranging from 77 to 94 dBA at non-heliport sites. This means a person at one of these three measured sites would hear an increase from 47 to 77 dB from normal background noise, per event. Using the information presented, this means a resident would experience noise events that were between 16 and 128 times as loud as normal. To say the least, this would be disruptive in the extreme. This certainly could be considered a "taking" of a person's right to the quiet enjoyment of their property. (Attached please find information regarding how property values decline near airports.) In this regard there is ample literature available (from the US Forest Service and even NASA) concerning the "annoyance" component of helicopter generated noise, and ample information regarding health impacts such as increased stress levels. Unfortunately, none of this information made it into the Noise Study.

FAR Part 150 explains the purpose of a Noise Exposure Map, which requires identifying present and future noise patterns. This is obviously important for airport planning. While 9 events does not create a pattern, the concept that there may be significantly more than 9 events per each 7 day period in the future is neither considered nor analyzed in the Haines report.

It must be said that DNL methodology used in this report could be used to justify citing a heliport just about anywhere in the Borough, perhaps even next door to where you live. Municipalities confine aviation noise to one or two airports for a reason. The three existing heliports are already excessive considering the amount of helicopter use.

The Haines Noise Study is further deficient in that it does not state if the events measured occurred underneath flight paths, which would affect the amount of noise recorded at each site. Also Nicholas mentioned in the CVN that the flight logs (not available on the Borough web site) indicated the helicopters were flying at 200 feet AGL. If this is indeed the case, 14 CFR Part 135 was violated, as it requires a 300 foot minimum AGL.

The Haines Borough has wasted an incredible amount of time, energy, and money on this issue. The Planning Commission decision to deny a permit should be upheld.

Thank you for the opportunity to comment.

Nancy Berland

AVIATION NOISE LAW
Airport Noise and Residential Property Value

Effects of Airport Noise on Housing Value

In 1994 the consulting firm of Booz-Allen & Hamilton, Inc. prepared a report titled The Effect of Airport Noise on Housing Values: A Summary Report for the Federal Aviation Administration. The report describes a methodology for evaluating the impact of noise on housing values. The methodology essentially compares market prices in similar neighborhoods that differ only in the level of airport-related noise. In pilot studies using this method, Booz-Allen found that the effect of noise on prices was highest in moderately priced and expensive neighborhoods. In two paired moderately priced neighborhoods north of Los Angeles International Airport, the study found "an average 18.6 percent higher property value in the quiet neighborhood, or 1.33 percent per dB of additional quiet." (See Bibliography: Impacts of Noise on Property Value.)

A 1996 study funded by the Legislature of the State of Washington used a somewhat similar methodology and found that the proposed expansion of Seattle-Tacoma Airport would cost five nearby cities $500 million in property values and $22 million in real-estate tax revenue. The study of single-family homes -- all in "very good" condition, with three or more bedrooms and two or more baths, and excluding the most expensive and inexpensive units to provide more representative comparisons -- found that "a housing unit in the immediate vicinity of the airport would sell for 10.1 percent more -- if it were located elsewhere."

The Washington study also concluded: "all other things remaining equal, the value of a house and lot increases by about 3.4% for every quarter of a mile the house is farther away from being directly underneath the flight track of departing/approaching jet aircraft." (Details can be found in Sections 9.01 - 9.07 of the study.)

In 1997 Randall Bell, MAI, Certified General Real Estate Appraiser, licensed real estate broker, and instructor for the Appraisal Institute, provided the results of his own professional analysis to the Orange County Board of Supervisors. Comparing sales of 190 comparable properties over six months in communities near Los Angeles International Airport, John Wayne Airport, and Ontario Airport, Bell found a diminution in value due to airport proximity averaging 27.4 percent. (See the full report.) Bell has also developed a list of over 200 conditions that impact real estate values -- airport proximity is categorized as a "detrimental condition."

Disclosure of Airport Noise to Buyers

California law requires sellers to reveal noise and other nuisance factors in a Real Estate Transfer Disclosure Statement prior to sale, permitting prospective buyers to look elsewhere or to lower their offers.

As of January 1, 2004, residential property owners in California are required, under certain circumstances, to disclose to prospective buyers that the property is in the "vicinity" of an airport (Assembly Bill 2776, 2002). (See AB 2776.)

Avigation Easements

Airports can acquire avigation easements in the airspace over neighboring properties in order to (1) prevent construction of buildings and towers, planting of trees, installation of lighting, or any other development that might interfere with aircraft takeoff and landing, or (2) protect against liability for any nuisance caused by airplanes using the airport, i.e., the impact of noise, fumes, and vibration on the "use and enjoyment" of properties under the flight paths to and from the airport. The former is a type of "hazard easement" while the latter is a type of "nuisance easement" but in practice both are called avigation easements. The two types are not typically combined in one legal document, although they may be.

Airports rarely take the trouble to acquire nuisance avigation easements by initiating condemnation proceedings. The nuisance easements are sometimes imposed on new developments near an airport, but only if the airport owner (a city or county) also has jurisdiction over the land surrounding the airport. An airport may also require a nuisance avigation easement as a condition for installing insulation against noise in homes and schools. When sued for nuisance by neighboring landowners, airports assert that they have a prescriptive avigation easement over the plaintiff's land and therefore are not liable for any nuisance due to aircraft noise, fumes, or vibration. In theory a prescriptive avigation easement is acquired by simply flying over the property for a number of years (the number set by state law to perfect a claim for adverse possession). However, only California courts have come close to recognizing avigation easements acquired by prescription (see link below to discussion of prescriptive avigation easements).

If the provisions of the easement are written broadly, the easement could preclude the property owner from successfully suing the airport for maintaining a nuisance (such as noise, air pollution, or airport lighting). For example, the easement might contain language that grants the airport the right to create noise, dust, vibration, fumes, etc. from aircraft presently using the airport as well as any future aircraft at the airport. If at the time the easement was granted the airport was used only by small, propeller-driven planes, but now a variety of helicopters fly in and out of the airport, the property owner would have difficulty arguing that the airport had exceeded its rights under the easement.

Avigation easements are recorded in the county recorder's office and show up in a title search. Like most easements, they are binding on any future owners of the property. See the following:

California Public Utilities Code section 21652 (statutory authority for avigation easements)

Sample avigation easements: California sample, FAA model

Prescriptive Avigation Easements

"Avigation Easements, and Lawsuits for Inverse Condemnation and for Nuisance" by Ronald D. Steinbach, Attorney at Law (California)

[Revised Nov. 13, 2004]

From:	Nicholas Szatkowski
To:	Julie Cozzi; David Sosa; jessica meadow
Subject:	Noise Report comments
Date:	Friday, June 26, 2015 4:56:42 PM
Attachments:	Szatkowski Noise Report Comments, 26Jun2015.pdf

Hello Haines Borough Administration-

I have included my comments as an attachment in the preferred pdf format. However, I have also copied the same comments into the text of this email below.

Thanks for reading them!

The only really meaningful things established by the report are that our neighborhood is normally extremely quiet, and that the helicopters are really loud. The report authors included lots of graphs and text that recalculate and refigure this basic information in ways that hide the basic facts.

Report's methodology invalid

The only metrics in the report which are relevant to our situation in planning Heliport sites in the Haines Borough are "single event metrics" because they are the only representation of the real volume of helicopters experienced in the neighborhood. Single event metrics (Lmax, and SEL) simply report actual recorded sound volume. Very simple, easy to understand, and provide accurate reflections of actual noise events. This is the only measurement of sound that is appropriate for comparing noise impacts of specific loud events in the context of a quieter background noise environment. The SEL graphs are mostly detailed in Appendix A. Sound Exposure Levels during the test period range from a (loud) low at the furthest test site of 69.5 dBA to a (painfully loud) high of 120.9 dBA at the nearest. (SELs combine the recorded Lmax with the duration of the sound event into a single metric, to offer a single number representing total noise impact of an event).

By contrast, "cumulative" (i.e., averaged) metrics become very convoluted. They involve sometimes complicated formulae which average the sound of a single event with other, unrelated sounds or background sound. Therefore, metrics such as LEQ (hourly averages) and DNL (daily averages) give a distorted view of actual noise events. For example, during one hour with background sound of 35 dBA, a helicopter might refuel, for 5-10 minutes, causing sound of 83 dBA. The LEQ would average these out, using a complicated formula, and end up with a number around 50-60 dBA. But the sound of the helicopter is not 55 dBA, it's actually 83 dBA. The metric called DNL is even further off-base in our particular situation, as it averages the helicopter sounds (which of course still occur at the same volume) with the quiet background sound level of the entire day and night, over 24 hours. This is why the report can say that at the adjacent property, the DNL was the very moderate sounding 51 dBA, even though the Lmax of the helicopter was consistently recorded at 82-87 dBA (SELs. This comparatively low number is not the result of the quietness of the helicopter, but rather the result of the quiet background noise level. In other words, the quieter the ambient noise of the neighborhood, the lower the DNL, even though the helicopter noise is just as loud as it is in a loud location. The DNL metric is therefore especially inappropriate for determining the impact of loud sounds within quiet environments, because quieter locations will have lower DNLs, falsely masking the true volume of the loud sound events. A 2011 FAA technical report contained the following caution, **"DNL has another major practical limitation. It doesn't work particularly well as a predictor of aircraft noise impacts."**
http://www.faa.gov/about/office_org/headquarters_offices/apl/research/science_integrated_modeling/noise_impacts/media/6-14-2011_FinalReport_MetricsMestre_etal_061411_part1.pdf

Using DNL as its justification, the noise report is attempting to assert that if you take a very quiet place and add a very loud noise for a relatively short period of time, you get a moderately quiet place, when actually, what you get is a very quiet place with a very loud thing in it.
No matter how quiet it was when you got up and had breakfast, when the loud helicopter sound occurs, you experience it at its volume at that moment. In fact, the quieter the background is, the *MORE* disruptive loud sounds are, because they are so out of place, and they shatter the peace that otherwise prevails.

Additionally, even if DNL were to be used, it could only have any possible meaning if the number of helicopter landings during the test period were exactly the same as they would be in a real situation. SEABA landed at the site 9 times during the entire week of the noise test. And according to SEABA's own biweekly operations/skier day report, only the 4 landings on March 9th were actually transporting skiers to the mountains, reflecting actual conditions of a real heliski operations base. In regular operations that number could easily be 90 landings or even more (2 helis per day, all day, times 7 days). So the average sound (DNL) would be enormously higher. But of course we don't have that actual number. Therefore the Noise Study's data set isn't reflective of the very thing it was supposed to measure. Again, ***all averaged metrics (LEQs and DNLs) in the report are invalid, because they aren't based on conditions equivalent to real operations at the site, but rather on a minimized sample of helicopter traffic.***

Also, the study's recording of actual sound measurements was skewed for the following reasons:

-all of SEABA's flights using the 26-mile helipad skimmed the treetops on approach and departure, without even attempting to reach the elevations (minimum 1500' AGL in all cases,and 2640' AGL above valley floors) required under their existing Borough permit. Their failure to abide by this requirement was reported to the Borough multiple times, and the administration labeled the reports as "unsubstantiated allegations" even though the GPS data showed the citizen reports to be accurate. Flying in this manner very significantly changed that sound signature of the helicopters during the noise test period, so that only the Corona property (adjacent to SEABA) experienced sound levels that would occur if the helicopters flew in accordance with the requirements of the tour permit.
This means that only the data recorded at that location ("home by helipad") has relatively accurate readings. (We don't know if the noise recording equipment was located inside or outside the Corona cabin, which would make an obvious difference in recorded noise levels. If the decibel recorder was actually inside the cabin, then even those data are invalidly decreased, because property rights apply at owners' property lines, not just inside our homes or cabins). **This is yet another reason the results of the study do not reflect the actuality of lawful, regular operations of a commercial heliport at the site.**

-The FAA uses a very specific metric for measuring helicopter sounds, called Effective Perceived Noise Level (EPNL). The study didn't use this metric approved and used by the FAA. The report authors not only failed to explain why, but they also failed to even mention knowledge of EPNLs.

-the entire study used ONLY the "A-weighted" decibel scale, rather than recording the actual volumes as raw data. The A-weighted system is a curve that subtracts more and more from actual recorded dB as frequency decreases. From very low frequencies, as much as 50dB would be subtracted from the actual dB level that truly occurred (see page 9 of the report). This weighting scale was created to attempt to emphasize sounds in the mid-frequency range that are more clearly heard by most people. But it distorts the actual record of the true volume of sound pressure. The report states that "most community noise analyses are based upon the A-weighted decibel scale". However, it is not appropriate for measuring low-frequency sound emitters, such as helicopters. A thorough, professional account of A-weighting scales would acknowledge that, in fact, there has been much questioning and criticism of A-weighting for measuring sources of low-frequency sounds such as those emitted by helicopters. The contract required Mead and Hunt to provide raw-data for helicopter noise measurements. They failed to meet this term of their contract, and only included the A-weighted numbers.

Conclusions Invalid and Unprofessional

The report falsely claims that the only standard available for comparison is the FAA's promotion of 65 dBA as a threshold for areas surrounding urban airports. This contention is wildly inaccurate, and undermines the credibility of the report

Even in urban Anchorage, noise regulations do not allow noise levels above 60 dB from crossing property lines in residential areas. (Because of the logarithmic nature of the decibel scale, 70 dB is 10 times higher than 60 dB. ***80 dB is 100 times the sound pressure as 60 dB***). ***Allowing a heliport at this site would be imposing noise onto neighboring properties that is 100's of times louder than would be allowed in urban Anchorage.***

*The WHO recommends the following guidelines, recognizing the following related health concerns:

> *For outdoor living areas, a 55 dB noise level will result in "serious annoyance". 50 dB will result in "moderate annoyance," daytime and evening.*
>
> *For indoor dwellings, for speech intelligibility, noise levels should not exceed 35 dB.*
>
> *For sleep disturbance, 30 dB background; 45 dB is expected to wake, or otherwise disturb, a sleeping person.*
>
> *In outdoor parklands and conservation areas, "existing quiet outdoor areas should be preserved and the ratio of intruding noise to natural background sound should be kept low."*
>
> *..."For indoor environments, reverberation time is also an important factor. If the noise includes* ***a large proportion of low frequency components****, still lower guideline values should be applied."*

The Haines Noise Report neighborhood ambient noise measurements show an extremely quiet background noise level, between 16 and 29 decibels. That's quieter than any category they have in their charts. Quieter than "Wilderness Residential," at 35 decibels, vastly quieter than 51 dB "Wooded Residential," which they attempt to characterize this neighborhood as being, and dramatically quieter than the 65 dBA level that is being proposed as a standard for our neighborhood. The report authors suggest that a drastic elevation in neighborhood decibel levels is appropriate, without any supporting evidence whatsoever for why this is acceptable on a social or municipal planning level. The Federal Noise Control Act of 1972 recognizes detrimental impacts of increasing neighborhood noise, and says that an increase of 20 dB *"will result in widespread, vigorous public opposition."*

Even with the dampening effects of A-weighting, the maximum noise levels measured during the study period ranged from 77.4 to 104.3 dBA at the four sites. All of these noise levels are above reference ranges for residential noise standards, standards preserving healthy hearing, and national and international standards protecting public health. (See Anchorage municipal codes, EPA Noise Control Act of 1972, and World Health Organization Guidelines for Community Noise.)

The Haines Noise Report concludes with a DNL metric, (mis)calculated by *averaging the excessively loud helicopter noise events with the extremely low ambient noise levels*. The study failed to use EPNLs, and the report fails even to acknowledge existence of this metric, the FAA's preferred and best metric for measuring helicopter sounds. The report's authors admit that they failed to use the FAA's Integrated Noise Modeling, which was another requirement of the contract they signed and were paid for. This model is the method used and approved by the FAA by which to arrive at a DNL. Nonetheless, having failed to use the modeling system approved by the FAA, Mead and Hunt make assertions about the expected noise levels in the neighborhood, at surrounding properties. However, they are using a sample time period during which SEABA was flying unlawfully, hiding their "cone of sound" from the noise monitoring stations. They are also using a preposterously small number of flight events to arrive at their DNL.

The Haines Borough was warned not to waste our public funds to pay an outside consultant for something that does not return meaningful value to the public. Measurements of ambient background versus helicopter sound levels could have been obtained for a small fraction of the price paid to Mead and Hunt. Most of the expense went to their analysis and production of a "cooked-book" report which appears to be using obfuscatory jargon and graphs to make it look like a very loud sound is somehow, impossibly, rather quiet. I wonder who in our Borough might have suggested that angle to Mead and Hunt.

sincerely,
Nicholas Szatkowski
26-mile
Chilkat Valley, Alaska

From:	Sally Boisvert
To:	Julie Cozzi; David Sosa
Subject:	Our comments on the recently published Noise Measurement Study
Date:	Thursday, June 25, 2015 10:20:40 PM
Attachments:	Noise Study Comments Rafe and Sally.docx

Hello Julie and David,

I hope you are well.

Please find attached the comments that Rafe and I wish to submit in regards to the recent Noise Measurement Study.

Julie, could you confirm receipt when you get our comments tomorrow? Thank you!

-Sally and Rafe

Sally Boisvert & Raphael McGuire
P.O. Box 578
Haines, AK 99827
(907) 767-5515

June 25, 2015

Hullo,

We are writing to share our opinion on the recently published helicopter noise report. It appears to us the most relevant part of the study was the measurement of how loud it was during the moments a helicopter was passing, which was extremely loud. The report indicated that averaged over an entire day, it wasn't that loud, at least not compared to a neighborhood near a commercial jetport. This is entirely irrelevant. How disruptive something is should be measured while it is occurring, not over an arbitrary extended time frame.

We have both worked around helicopters and it is distinctly obvious that they are incredibly loud and disruptive. This study measured the noise of a small number of flights and compared it to an average lower 48 neighborhood, whereas the reality is a very quiet and peaceful remote rural neighborhood being overrun by a much higher daily number of flights. Furthermore, the noise of a helicopter depends partly on how it is operated. Since the company operating the flights during this study has a strong interest in the outcome, they presumably flew to minimize noise, low to the trees and gently on the throttle. Normal operations could be substantially louder.

Helicopters are loud, too loud for a wooded residential neighborhood. The people who live near the proposed heliport say they think it is too loud. There are already several operating heliports nearby. This heliport in the 26 mile neighborhood should not be permitted. Nor should heli-ports be permitted in the nearby Moose Valley where we, and many other families reside.

We believe it would be in everyone's (i.e. the Haines Borough, the helicopter skiing industry, and local taxpayers) best interest to strategically locate heliports away from residents' homes; in so doing, the Haines Borough could continue to promote the successful helicopter-skiing industry, while the people of Haines who work in other local industries can continue to enjoy the places we reside year-round, and continue to be welcoming to winter ski tourists. Visitors often remark on how friendly and welcoming our small town is. Let's keep it that way by locating heli-ports away from the homes of the locals, who will then feel more inclined to continue to make heli-ski tourists feel welcome and invited.

Respectfully,

Rafe McGuire &

Sally Boisvert

P.O. Box 578

Haines, AK 99827

From:	Sally McGuire
To:	Julie Cozzi
Subject:	Fwd: Helicopter noise assessment comments
Date:	Friday, June 26, 2015 7:13:45 AM

Hi Julie, could you please post this with the other helicopter noise report comments? thanks, Sally
---------- Forwarded message ----------
From: **Sally McGuire** <chilkootmcguire@gmail.com>
Date: Fri, Jun 26, 2015 at 7:11 AM
Subject: Helicopter noise assessment comments
To: Sally McGuire <chilkootmcguire@gmail.com>

I have read the helicopter noise assessment. I must say I was surprised by the poor quality of the work- I would have expected better research from a college freshman (and especially considering what we paid for it). It also reads like it was written by an apologist for the wind industry.

To site something as noisy and disruptive as a heliport in a residential neighborhood is an example of exceptionally poor planning, bound to create serious problems. The point of any kind of zoning is to ensure neighborhood homogeneity and consequently peaceful coexistence. Those citizens of Haines who support heliskiing must have noticed by now that the people who have to live with it don't get used to it and they don't stop being angry about it. Those problems won't go away until the heliskiing industry is required to operate away from people's homes. Haines has endured many years of disruption and disintegration of community from this. Allowing SEABA to site their heliport in a small, formerly quiet, rural community will ensure that the problem continues.

The citizens of Haines who live up the highway do so because they value peace and quiet and are willing to pay for it (just driving back and forth to work costs a lot). They are well aware of the hypocrisy of their being forced to live in a helicopter landing zone, while downtown residents are protected from even as much as a crowing rooster.

Incidentally, the way the noise report should have been conducted would have been to send someone around to ask the neighbors what they think. Then you pool and weight responses from people who live close to the facility or under the flightpath. You put those who live a mile away into another pool, and so on. Any averaging that is done, if you want to average, should be only within each pool. Using averages to prove that an extremely loud noise is actually nice and quiet is a fine example of how to lie with statistics.

As far as I can see, the only point of spending forty grand of our money on this "noise assessment" study was to prove that the opinions of the people who live up there don't matter.

Sally McGuire

From:	David Sosa
To:	Julie Cozzi
Subject:	FW: comments for noise study
Date:	Friday, June 26, 2015 3:43:32 PM
Attachments:	CommentsforNoiseStudyatBSVproperty 6 26 2015.docx

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From: Sunny Sundberg [mailto:sunny@seaba-heli.com]
Sent: Friday, June 26, 2015 3:33 PM
To: David Sosa
Subject: comments for noise study

David see attached.
Thank you

Scott
Scott Sundberg
GM / Guide
SEABA LLC
www.seaba-heli.com
907 314 0445

To: Dave Sosa
Borough Manager

I would like to say that when asked for public comment on the study it was difficult to decide what to comment on. The study was done through empirical methods, it was meant to be objective and without the subjective content that has made this CUP so difficult to interpret.
I think the last paragraph of the study below sums up the considerations of this study:

"As stated above, the three sites outside the helipad ranged from 30-51 DNL. Typical noise measurements at an average "wooded residential" land use is generally around 51 DNL. This means that the measured average noise level at the three sites fairly closely matches, or is quieter than what would be expected in wooded residential or quieter land use types. However, it is important to note that these comparisons do not link to any specific noise standard or regulation, but rather give a generalized comparison between what is typical in similar land uses and the results measured during this Study".

Also, after reading through it a couple of times, it dawned on me that the noise levels that are near or close to light commercial noise determined by the study only would affect 5% of residences out in the 26 mile area. In effect information stating otherwise was not present.
Context number 1:
This area is zoned generally allowed use, which encompasses about every imaginable use from private residential, to commercial and even heavy industrial. The report say that during this testing and information gathering period that the dnl levels stayed very close to what one might experience in a wooded residential area. This is stated as 30-51 DNL.
In this context the DNL levels could be much higher and still be compatible with all the allowed land uses in this area.
In the chart that they use to compare noise in figure 2-2 they group these same decibel levels, 30-51 as quiet.
Context number 2:
The Lmax time duration of the events is limited to when the heli is going to take off and land. In the appendixes you can look at each event and determined that the average amount of noise generated at the location averaged around 4 minutes and 45 seconds, the LMAX averages total 85 seconds per occurrence. 75% of the remaining noise is 90% lower.
If you had a rock crusher or a sawmill running at this site,(both do not need a permit under current zoning) which at the industrial scale both generate peak noise over 110 decibels, with an average length of time for peak noise could be 6 plus hours a day.
A helicopter landing and taking of 20 times a day would have a LMax duration of 1700 seconds or 30 minutes over the course of the working day. This would account for only 10 percent of the industrial noise generated by a permitted activity like a rock crusher or sawmill.
Comparatively one could conclude that the allowed uses are much more intrusive, probably do create a level of undo noise, and generate a more continuous LMAX and SEL levels. So why is this activity supposedly given so much attention? Why are we even discussing this issue.

Context 3:

In everyday life through the borough, along highways, and in the commercial and residential areas of the borough, sound is generated from 7 in the morning to 11 at night in some circumstances.
Turner Construction operates a CUP gravel pit at the top of 4th street next to residences. Large equipment cut into the hillslopes above the residences, load trucks with gravel, and then proceed down the hill through the residential area to deliver their product to customers.
In terms of noise there are probably similar if not higher noise levels involved with this activity. It also would qualify that unlike the 4th street gravel pit, helicopters noise moves away from all residences over public lands identifiednear the test site,over lands allocated as resource development and multi purpose recreation.This includes recreation machinery that delivers high levels of noise. This happens both in personal recreation, as well as commercial operations. Noise is part of everyday life in economy and in enjoyment. For true quiet one must retreat to wilderness, and even then a International jet can disturb the solace.

My other thoughts after giving certain scenarios demonstrating realities associated with this topic, I want to mention a few things about the environment of the study.
Haines and specifically 26 mile had a very light snow year. This affected a few crucial aspects that were not in the study.

1. As a result of the low snow levels, SEABA was forced to cancel it snowcat tours which leave from the immediate study area. In 2014 we did 28 cats ski trips. An abundant amount of ambient or background noise was left out of this study because of this. Noise not captured that normally would exists would include snow plow riggs both for state and private roads near the study area, private vehicles using BSV and SEABA roads to get to the activity, the startup and shutdown of the SEABA snow cat which is a diesel tractor that needs to warm up and cool down every time it departs for the excursion.
2. We also have snow mobile tours that leave from this area that were not facilitated because of low vegetation cover as well. We had enough snow to move the machine on the snow, but because of the lack of deep snow our rental business and general activity was down 80%. Most rental occur with deep snows that the riders are targeting.

This noise study identifies that while there is noise, it is no greater than what has been and is accepted throughout communities including ours, noting the example of the 4th street in commercial and more importantly in line with residential areas.

Without a doubt I feel that this study demonstrates that this is a compatible use for this area, giving the current zoning, and the relatively infrequent amount of noise that is will contribute to the area.

Finally the other comment is that noise is apart of any economy, and thiszoning within in the borough was specifically left open for private landholders had options to do what they want. Unde consolidation this was requested and lobbied for during consolidation by the people who owned property outside of the town site.
When the borough assembly added the requirement to get a CUP from the Planning and Zoning, under title 5, if a person wanted to develop a heliport, it errored by not allowing the

exclusion of Generally allowed uses. This study shows that if the proposed development of a heliport was in a residential or commercially zoned area, then the validity of getting a CUP has merit.
I believe an easy fix for the borough is to remove this condition from ordnance from title 5, and put into title 18 under the appropriate zoning.

Thank you for your time.

Scott Sundberg

From:	Thom Ely
To:	Julie Cozzi
Cc:	David Sosa; Lynn Canal Conservation; Chilkat Valley News; AQRC Board
Subject:	Helicopter Noise Study - Public Comment
Date:	Wednesday, June 24, 2015 6:55:34 AM

Dear Haines Borough,

The results of the Helicopter Noise Study at the 26 mile residential area came out exactly as predicted. Helicopters make noise at a level that bothers some people and not others.

The fault in the study is that the flight path and elevation of the helicopter was not regulated or monitored. In addition, nine flights is an extremely low sample. The noise monitoring stations were set up, but no official was there to tell the pilot where and at what elevation to fly. This lack of data parameters and scientific analysis renders the study useless.

In addition weather data for the days that the monitors were in place was not collected or factored in. Wind direction and velocity affect the soundscape. The microphones had wind shields on them but this has no relation to how the rotor noise is affected by the wind.

The 70 DNL standard used for comparison in a wooded residential area is also subjective. Most people living in the Chilkat Valley want peace and quiet at home. This local standard may be 25 DNL. That is why there are noise ordinances in residential areas. Dogs barking, heavy equipment working, chainsaws and helicopters are all considered a nuisance and annoyance.

The fact of the matter is that heliports do not belong in residential areas. If approved, as an adjacent property owner I would pursue legal action and monetary compensation from the Haines Borough. All commercial aviation needs to take off and land at at the Haines Airport.

Sincerely,

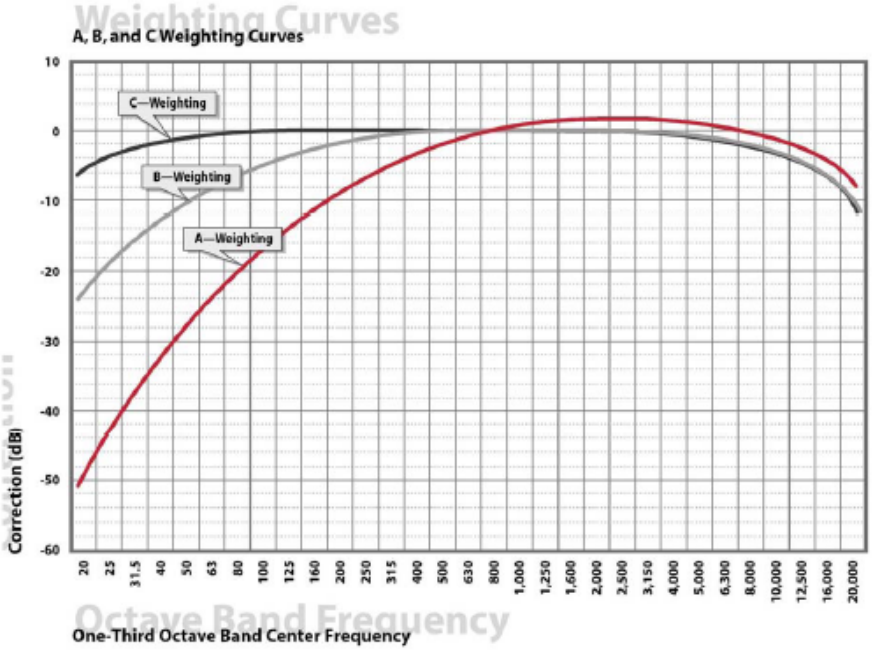
Thom Ely
POB 1014
Haines, AK 99827

Planning Commissioners, Assembly members, and other concerned citizens,

Please study the following two charts, in order to better understand the degree to which A-weighting skews the reporting of helicopter noise, and therefore, the results of the noise study. The first is a chart from Section 2, on page 3 of the Final Draft Haines Noise Study, which shows three options for so-called "weighting" of noise frequencies, the A, B, and C weighting curves. "A-weighting," on paper, removes as much as 50 decibels of medium and low frequency noise from the actual noise levels.

The second chart is from a 2010 joint FAA/DOT study showing the large quantity of mid- and low-frequency noise generated by helicopters— noise that is entirely or greatly discounted by the methodology used by Mead and Hunt. As you can see by studying the two charts, some of the greatest sound pressure produced by the helicopter's rotors is at ranges which are dramatically discounted by A-weighting. The chart says that at 1000 feet, the rotors produce about 61.8 decibels in the 25 Hz band, and 81.5 decibels in the 31.5 Hz band. Mead and Hunt have erased these noise bands (on paper) by nearly 40 decibels— that's a 10,000 times reduction.

Figure 2-1
FREQUENCY WEIGHTING CURVES
Borough of Haines Spring 2015 Helicopter Noise Survey

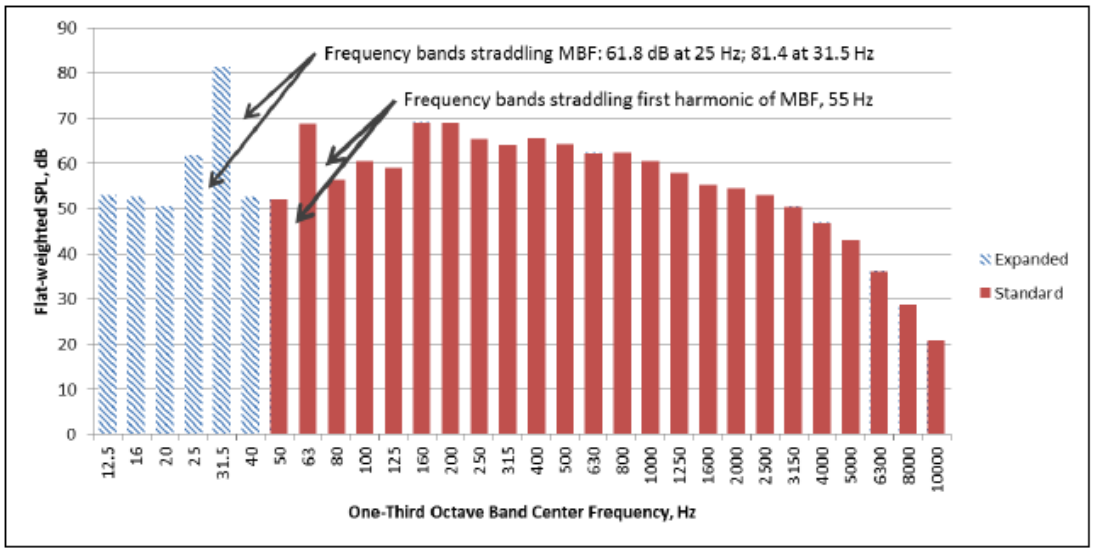


7. FIGURES AND TABLES

Table 1. Subject Helicopters

Aircraft	*Passenger Capacity (including pilot)*	*Main Rotor Blade Count*	*Main Rotor Blade-Pass Frequency (Hz)*	*Main Rotor RPM*	*Max. Gross Weight (lb)*
Helicopter A	*7*	*4*	*27.5*	*412.5*	*5000*
Helicopter B	*4*	*2*	*13.6*	*408*	*2400*
Helicopter C	*2*	*3*	*23.6*	*472*	*2050*

Figure 1. Helicopter A Departure, Source Normalized to 1,000 Feet



The loudest sounds produced by helicopters are discounted by A-weighting. In the above FAA/DOT chart, the noise bands represented in blue are those that are reduced or eliminated by A-weighting. The sound of 440 hertz is the A note just below middle C on a piano—not a particularly low note. It is a note which the typical female vocalist would easily deliver during a song. This is the note below which Mead and Hunt, via A-weighting, have altered the data, falsely reducing the actual sound pressure data. The majority of helicopter noise is widely recognized to occur below this note, in

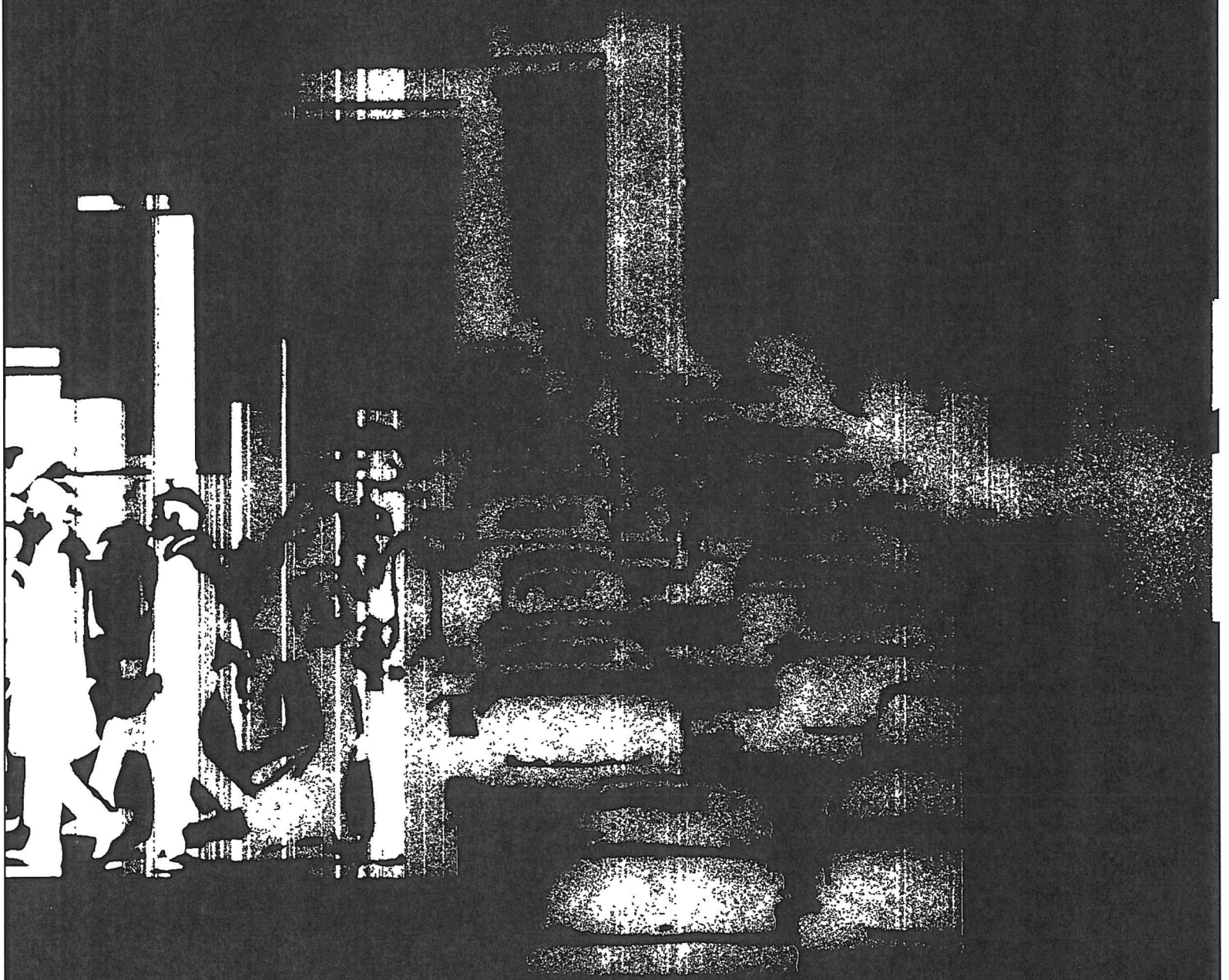
the lower frequency range. The contract that Mead and Hunt signed with the Haines Borough specified that they would provide “unweighted, ‘raw’ sound data measured in decibels.” That data sits in a file in the borough office, unrepresented in either the draft or the final reports. Without full access to the unaltered numbers, we can only speculate about what the true sound pressure levels were.

Agency Washington, D.C. 20460

EPA

Protective Noise Levels

Condensed Version of EPA Levels Document



PURPOSE

This publication is intended to complement the EPA's "Levels Document,"* the 1974 report examining levels of environmental noise necessary to protect public health and welfare. It interprets the contents of the Levels Document in less technical terms for people who wish to better understand the concepts presented there, and how the protective levels were identified. In that sense, this publication may serve as an introduction, or a supplement, to the Levels Document.

*"Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," EPA/ONAC 550/9-74-004, March, 1974.

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INTRODUCTION

During the last 20 years there has been increasing concern with the quality of the environment. Along with air and water contaminants, noise has been recognized as a serious pollutant. As noise levels have risen, the effects of noise have become pervasive and more apparent.

Noise is defined as "unwanted sound." In the context of protecting the public health and welfare, noise implies adverse effects on people and the environment. Noise causes hearing loss, interferes with human activities at home and work, and is in various ways injurious to people's health and well-being. Although hearing loss is the most clearly measurable health hazard, noise is also linked to other physiological and psychological problems.

Noise annoys, awakens, angers and frustrates people. It disrupts communication and individual thoughts, and affects performance capability. Noise is one of the biological stressors associated with everyday life. Thus, the numerous effects of noise combine to detract from the quality of people's lives and the environment.

Noise emanates from many different sources. Transportation noise, industrial noise, construction noise, household noise, and people and animal noise are all large-scale offenders. It is important, then, to examine the total range and combination of noise sources and not to focus unduly on any one source.

Through the Noise Control Act of 1972, Congress directed the Environmental Protection Agency (EPA) to publish scientific information about the kind and extent of all identifiable effects of different qualities and quantities of noise. EPA was also directed to define acceptable levels under various conditions which would protect public health and welfare with an adequate margin of safety. The EPA collaborated with other Federal agencies and the scientific community to publish a "Levels Document,"* which would fulfill these requirements in the Noise Control Act.

Initial public reaction was quite favorable, but it was discovered that the document was too complex, too technical, and too long for some audiences. This summary presents the contents of the Levels Document in less technical terms. It defines the basic measurement of noise, analyzes noise exposure, and presents the best understood effects of noise — hearing damage, speech interference, and annoyance — using information contained in the Levels Document. The identified protective levels are then summarized, followed by a number of often-asked questions and answers about the Levels Document.

No attempt has been made here to incorporate recent research findings pertaining to effects of noise on people. Considerable new information has developed since initial publication of the Levels Document, including new findings on community response to noise, sleep disruption, and speech interference. Summaries and analyses of some recent information on noise effects are available through EPA and other agencies.

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*"Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", EPA 550/9-74-004, March, 1974, U.S. Environmental Protection Agency, Washington, D.C. 20460.

ABOUT SOUND

The sound we hear is the result of a sound source inducing vibration in the air. The vibration produces alternating band of relatively dense and sparse particles of air, spreading outward from the source in the same way as ripples do on water after a stone is thrown into it. The result of the movement of the particles is a fluctuation in the normal atmospheric pressure, or sound waves. These waves radiate in all directions from the source and may be reflected and scattered or, like other wave actions, may turn corners. When the source stops vibrating, the sound waves disappear almost instantaneously, and the sound ceases. The ear is extremely sensitive to sound pressure fluctuations, which are converted into auditory sensations.

Sound may be described in terms of three variables:

1. Amplitude (perceived as loudness)
2. Frequency (perceived as pitch)
3. Time pattern

Amplitude

Sound pressure is the amplitude or measure of the difference between atmospheric pressure (with no sound present) and the total pressure (with sound present). Although there are other measures of sound amplitude, sound pressure is the fundamental measure and is the basic ingredient of the various measurement descriptors in the next section, "Measurement of Environmental Noise."

The unit of sound pressure is the decibel (dB); thus it is said that a sound pressure level is a certain number of decibels. The decibel scale is a logarithmic scale, not a linear one such as the scale of length. A logarithmic scale is used because the range of sound intensities is so great that it is convenient to compress the scale to encompass all the sounds that need to be measured. The human ear has an extremely wide range of response to sound amplitude. Sharply painful sound is 10 million times greater in sound pressure than the least audible sound. In decibels, this 10 million to 1 ratio is simplified logarithmically to 140 dB.

Another unusual property of the decibel scale is that the sound pressure levels of two separate sounds are not directly (that is, arithmetically) additive. For example, if a sound of 70 dB is added to another sound of 70 dB, the total is only a 3-decibel increase (to 73 dB), not a doubling to 140 dB. Furthermore, if two sounds are of different levels, the lower level adds less to the higher as this difference increases. If the difference is as much as 10 dB, the lower level adds almost nothing to the higher level. In other words, adding a 60 decibel sound to a 70 decibel sound only increases the total sound pressure level less than one-half decibel.

Frequency

The rate at which a sound source vibrates, or makes the air vibrate, determines frequency. The unit of time is usually one second and the term "Hertz" (after an early investigator of the physics of sound) is used to designate the number of cycles per second.

The human ear and that of most animals has a wide range of response. Humans can identify sounds with frequencies from about 16 Hz (Hertz) to 20,000 Hz. Because pure tones are relatively rare in real-life situations, most sounds consist instead of a complex mixture of many frequencies.

Time Pattern

The temporal nature of sound may be described in terms of its pattern of time and level: continuity, fluctuation, impulsiveness, intermittency. Continuous sounds are those produced for relatively long periods at a constant level, such as the noise of a waterfall. Intermittent sounds are those which are produced for short periods, such as the ringing of a telephone or aircraft take-offs and landings. Impulse noises are sounds which are produced in an extremely short span of time, such as a pistol shot or a hand clap. Fluctuating sounds vary in level over time, such as the loudness of traffic sounds at a busy intersection.

MEASUREMENT OF ENVIRONMENTAL NOISE: SOUND DESCRIPTORS

EPA has adopted a system of four "sound descriptors" to summarize how people hear sound and to determine the impact of environmental noise on public health and welfare. These four descriptors are: the A-weighted Sound Level, A-weighted Sound Exposure Level, Equivalent Sound Level, and Day-Night

Sound Level. They are related but each is most useful for a particular type of measurement. The descriptors and some examples of their uses are described below.

A-weighted Sound Level

One's ability to hear a sound depends greatly on the frequency composition of the sound. People hear sounds most readily when the predominant sound energy occurs at frequencies between 1000 and 6000 Hertz (cycles per second). Sounds at frequencies above 10,000 Hertz (such as high-pitched hissing) are much more difficult to hear, as are sounds at frequencies below about 100 Hz (such as a low rumble). To measure sound on a scale that approximates the way it is heard by people, more weight must be given to the frequencies that people hear more easily.

A method for weighting the frequency spectrum to mimic the human ear has been sought for years. Many different scales of sound measurement, including A-weighted sound level (and also B, C, D, and E-weighted sound levels) have evolved in this search. A-weighting was recommended by EPA to describe environmental noise because it is convenient to use, accurate for most purposes, and is used extensively throughout the world. Figure 1 shows the A-weighted levels of some environmental noises. Note that these ranges of measured values are the maximum sound levels.

The A-weighting of frequency also is used in the three descriptors discussed below. When used by itself, an A-weighted decibel value denotes either a sound level at a given instant, a maximum level, or a steady-state level. The following three descriptors are used to summarize those levels which vary over time.

Sound Exposure Level

Since the levels of many sounds change from moment to moment, this variation must also be accounted for when measuring environmental noise. One method for measuring the changing magnitude of sound levels is to trace a line on a sheet of moving paper, so that the movement of the pen is proportional to the sound level in decibels. Figure 2 illustrates such a recording, about which several features are noteworthy. First, the sound level varies with time over a range of about 30 dB. Second, the sound appears to be characterized by a fairly steady-state lower level, upon which are superimposed sound levels associated with individual events. This fairly constant lower level is often called the background ambient sound level.

Each single event in Figure 2 may be partially characterized by its maximum level. It may also be partially characterized by its time pattern. In the example, the sound level of the aircraft is above that of the background ambient level for about a minute, whereas the sound levels from cars are above the background level for much less time.

The duration of sounds with levels that vary from moment to moment is more difficult to characterize. One way is to combine the maximum sound level with the length of time during which the sound level is greater than a certain number of decibels below the maximum level — for example, the number of seconds that the sound rises from 10 dB below maximum, as in Figure 3.

Using this procedure one can measure the total energy of the sound by summing the intensity during the exposure duration. This procedure produces the second measurement descriptor, *sound exposure level* (L_S), referred to in the Levels Document as the single event noise exposure level (SENEL).

Equivalent Sound Level

Yet another method of quantifying the noise environment is to determine the value of a steady-state sound which has the same A-weighted sound energy as that contained in the time-varying sound. This is the third measurement descriptor, termed the *Equivalent Sound Level* (L_{eq}). The Equivalent Sound Level is a single value of sound level for any desired duration, which includes *all* of the time-varying sound energy in the measurement period. In Figure 2, for example, the L_{eq} equals about 58 dB, indicating that the amount of sound energy in all the peaks and valleys in the figure is equivalent to the energy in a continuous sound of 58 dB.

The major virtue of the Equivalent Sound Level is that it correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant. It is easily measurable by available equipment. It also is the basis of a fourth and final measurement descriptor of the total outdoor noise environment, the *Day-Night Sound Level* (L_{dn}).

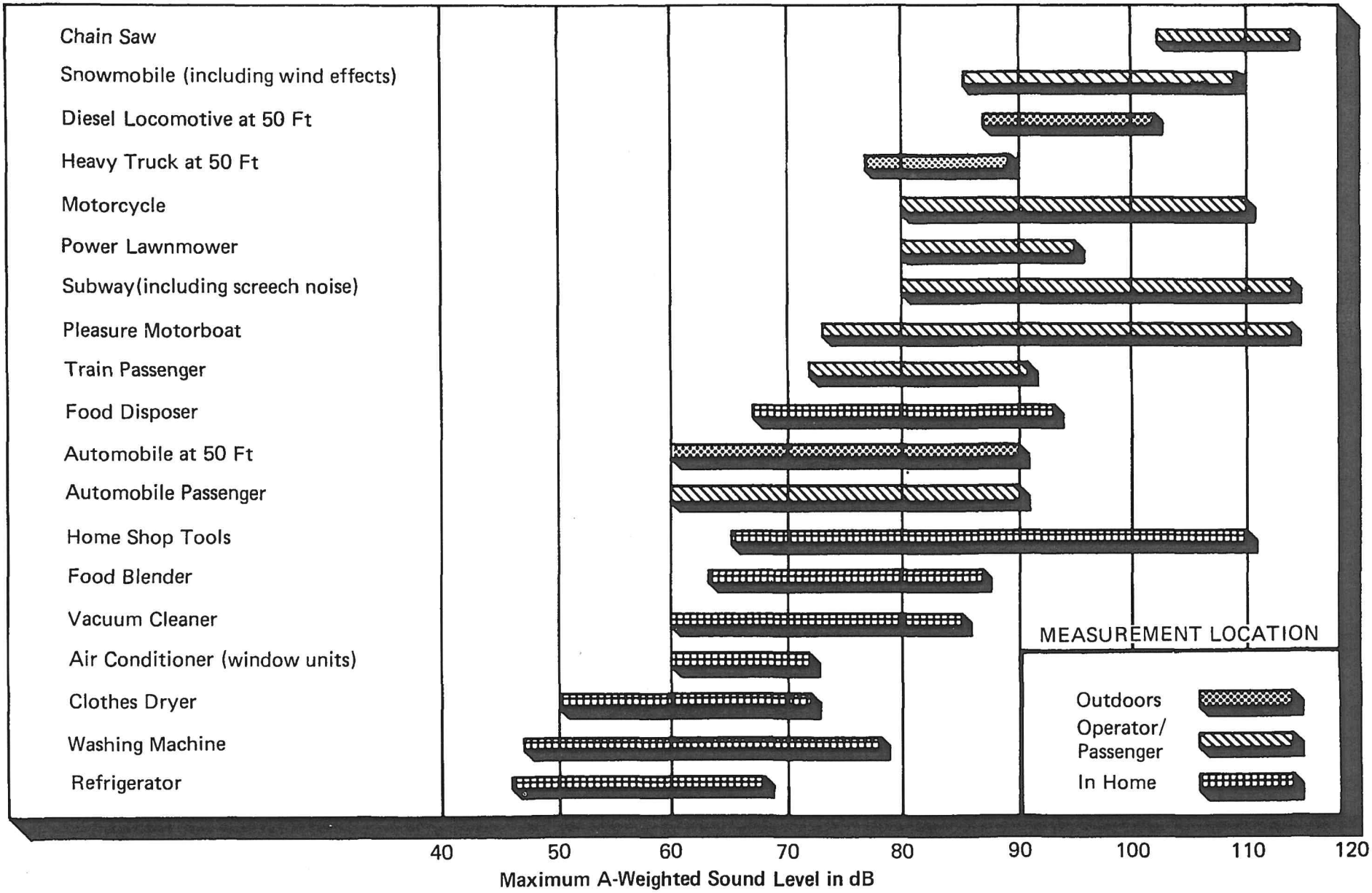

FIGURE 1. TYPICAL RANGE OF COMMON SOUNDS

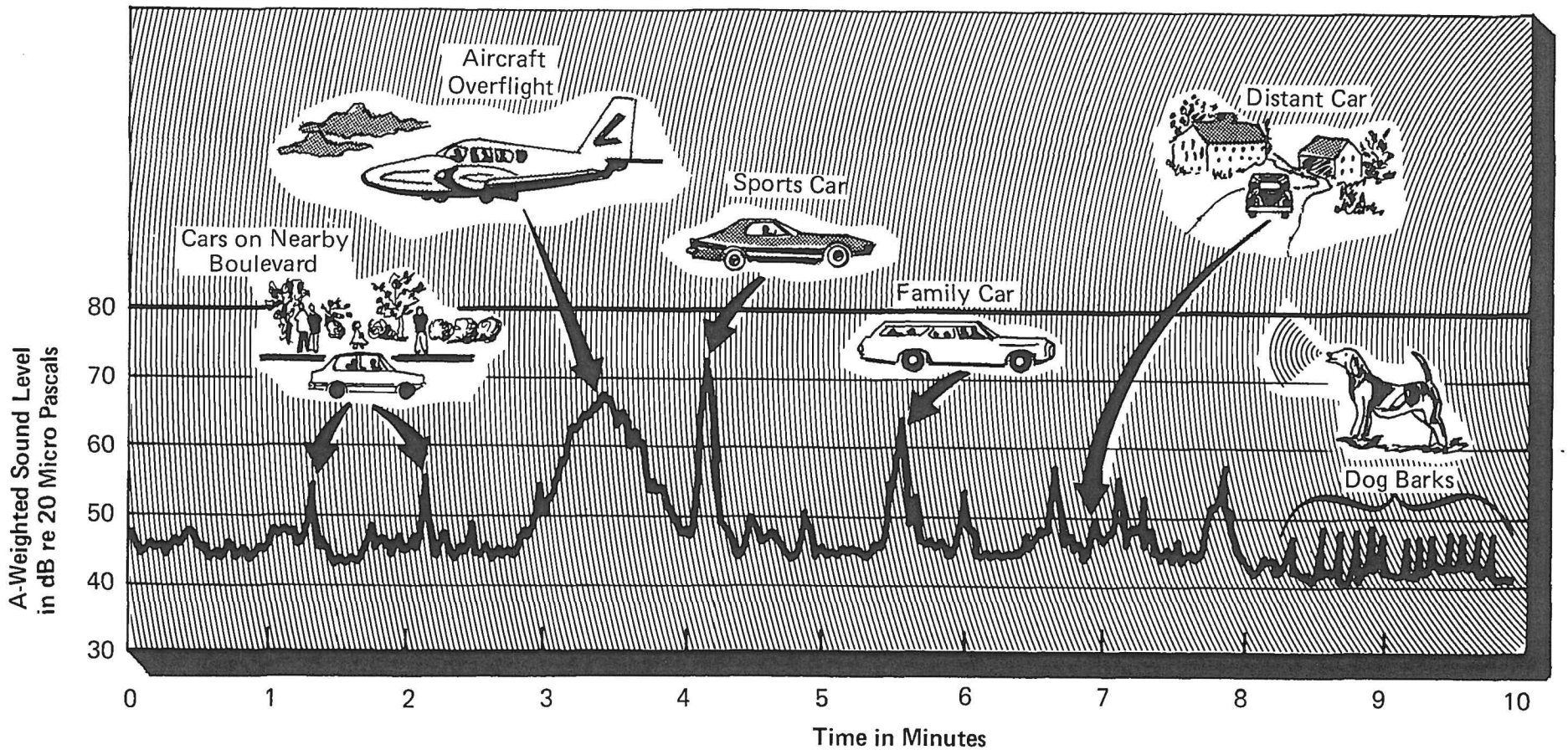

FIGURE 2. TYPICAL OUTDOOR SOUND MEASURED ON A QUIET SUBURBAN STREET

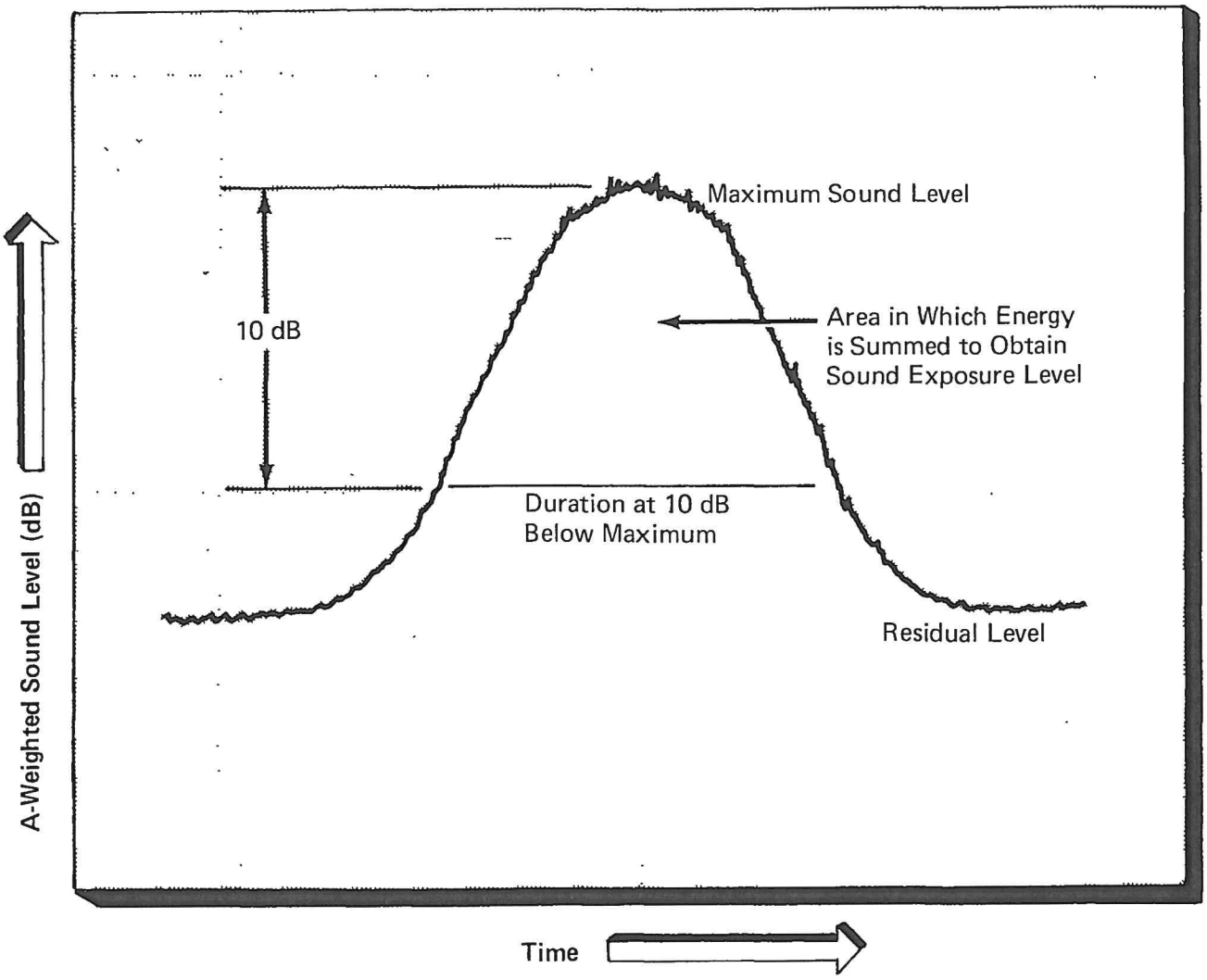

FIGURE 3. DESCRIPTION OF THE SOUND OF A SINGLE EVENT

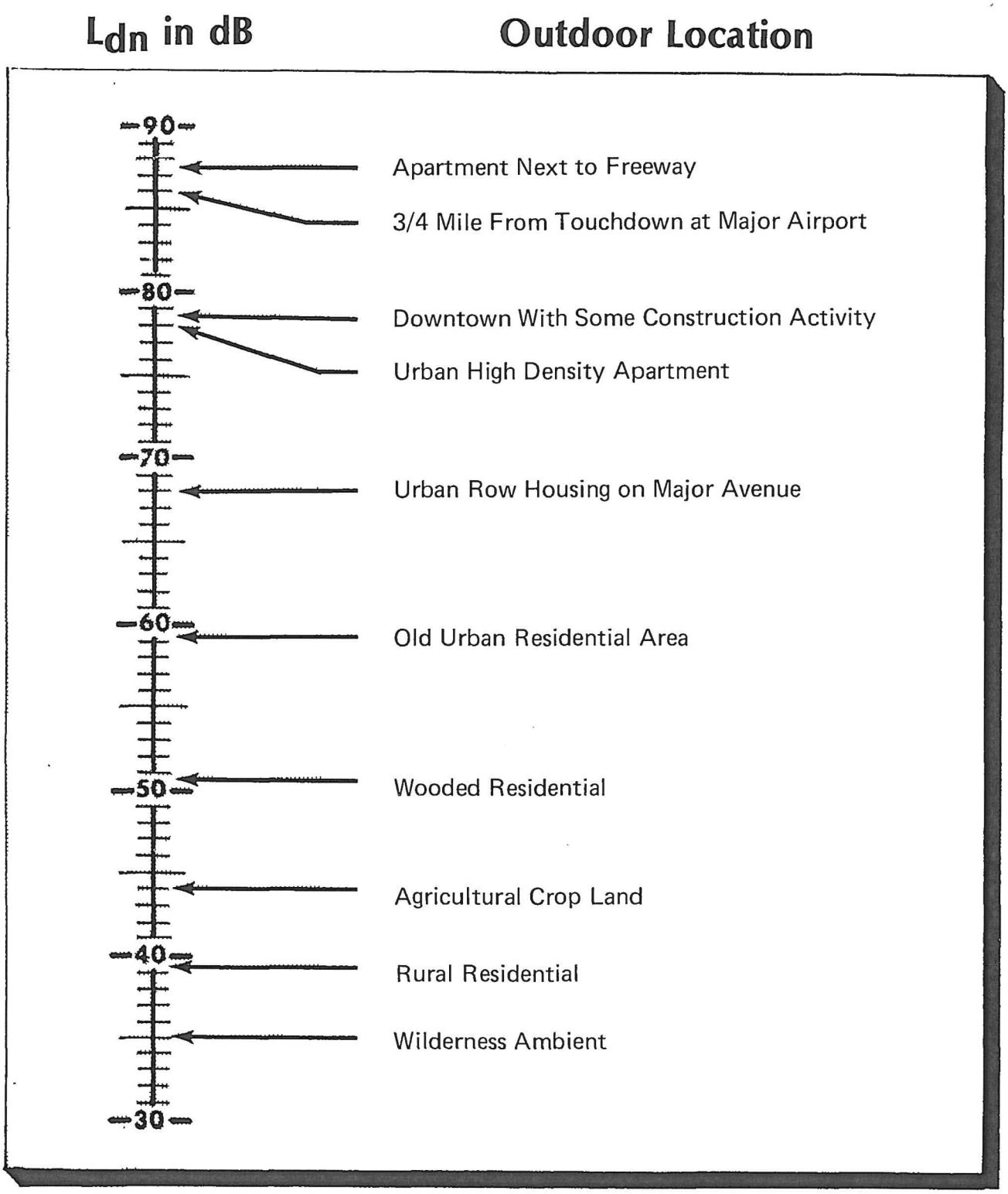

FIGURE 4. EXAMPLES OF OUTDOOR DAY-NIGHT AVERAGE SOUND LEVELS IN dB MEASURED AT VARIOUS LOCATIONS

Day-Night Sound Level

The Day-Night Sound Level is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB weighting imposed on the equivalent sound levels occurring during nighttime hours (10 pm to 7 am). Hence, an environment that has a measured daytime equivalent sound level of 60 dB and a measured nighttime equivalent sound level of 50 dB, can be said to have a weighted nighttime sound level of 60 dB (50 + 10) and an L_{dn} of 60 dB. Examples of measured L_{dn} values are shown in Figure 4. Table I summarizes the use of the four sound descriptors used by EPA.

Table I. Descriptors of Sound*

TYPICAL USE	NAME OF DESCRIPTOR	NATURE OF DESCRIPTOR
To describe steady airconditioning sound in a room or measure maximum sound level during a vehicle passby with a simple sound level meter.	A-weighted Sound Level	The momentary magnitude of sound weighted to approximate the ear's frequency sensitivity.
To describe noise from a moving source such as an airplane, train, or truck.	A-weighted Sound Exposure Level	A summation of the energy of the momentary magnitudes of sound associated with a single event to measure the total sound energy of the event.
To measure average environmental noise levels to which people are exposed.	Equivalent Sound Level	The A-weighted sound level that is "equivalent" to an actual time varying sound level, in the sense that it has the same total energy for the duration of the sound.
To characterize average sound levels in residential areas throughout the day and night.	Day-Night Sound Level	The A-weighted equivalent sound level for a 24-hour period with 10 decibels added to nighttime sounds (10 pm - 7 am).

*The unit for all descriptors is the decibel.

LEVELS OF ENVIRONMENTAL NOISE IN THE UNITED STATES

In residential areas of the United States, major contributions to outdoor noise come from transportation, industrial, construction, human and animal sources. Inside homes, appliances, radio and television, as well as people and animals, are predominant noise sources. On the job, workplace equipment can create moderate to extremely high levels of noise. The daily noise exposure of people depends on how much time they spend in different outdoor and indoor locations and on the noise environments in these places. Typical daily exposure patterns are discussed in this section, following short descriptions of outdoor and indoor levels of environmental noise throughout the United States.

Outdoor Levels

The noise environment outside residences in the United States can be highly variable. As seen in Figure 4, outdoor Day-Night Sound Levels in different areas vary over a range of 50 dB. Levels occur as low as L_{dn} = 30 to 40 dB in wilderness areas and as high as L_{dn} = 85 to 90 dB in urban areas.

Most Americans live in areas with a much smaller ranger of outdoor noise levels. Figure 5 shows that for urban dwellers (roughly 135 million people, more than half the U.S. population), 87% live in areas of L_{dn} = 48 and higher from traffic noise alone. Most of the other 13% of the urban population experience lower noise levels than those of Figure 5. Figure 5 also shows that nearly half of the urban population live in areas exposed to traffic sounds that range over only 5 dB (L_{dn} = 55 to 60 dB). Rural populations enjoy average outdoor sound levels generally lower than L_{dn} = 50 dB.

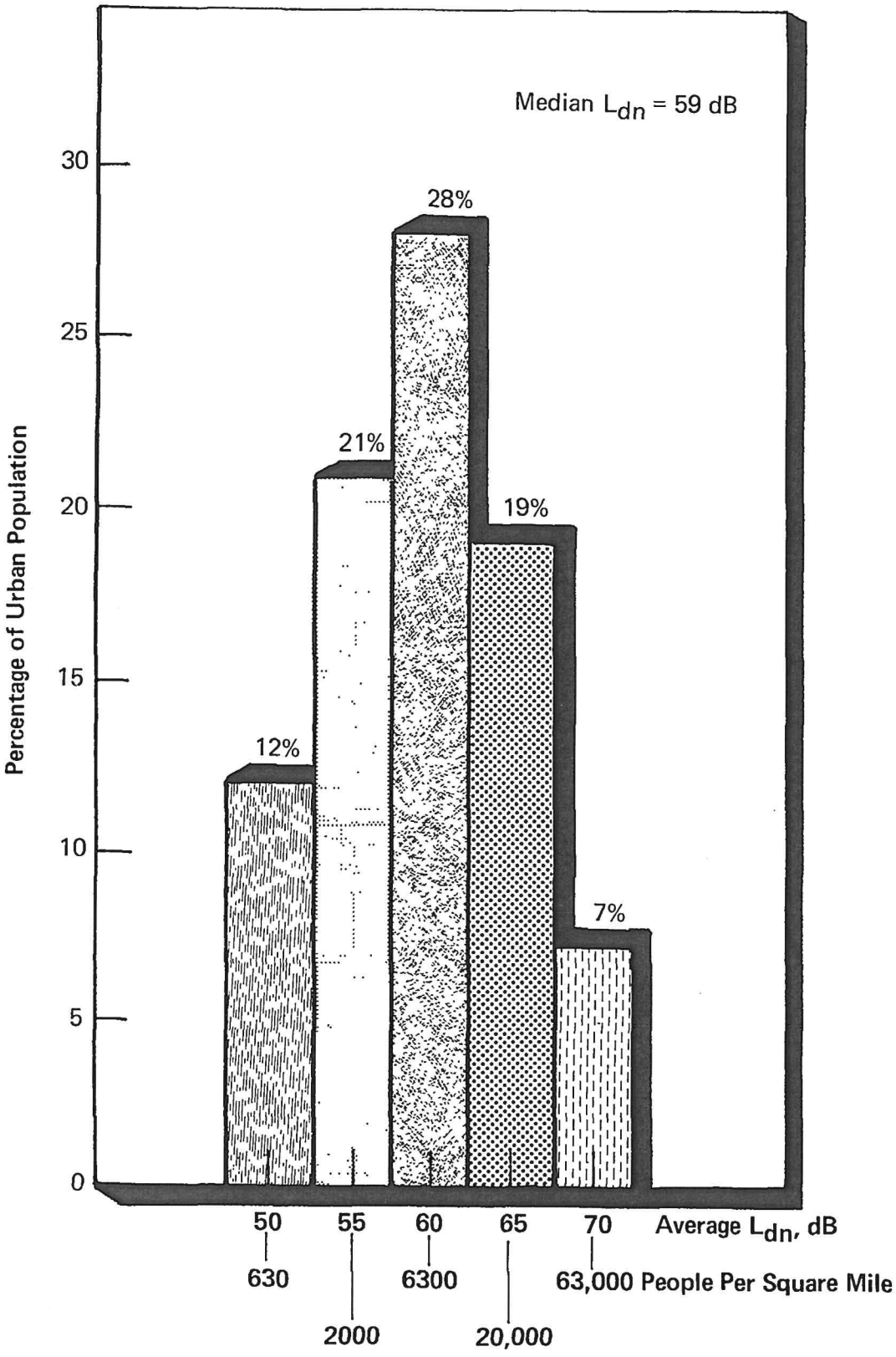

FIGURE 5. ESTIMATED PERCENTAGE OF URBAN POPULATION EXPOSED TO OUTDOOR DAY-NIGHT SOUND LEVELS DUE TO TRAFFIC

It is useful to know the number of people living in areas characterized by different levels of environmental noise. Figure 6 presents estimates for urban traffic, freeway traffic, and aircraft noise. The figure shows that urban traffic noise is much more widespread than either aircraft or freeway noise, but the figures are not strictly additive, because many of the people counted in one category are also exposed to another category of noise. Fifty-nine million people live in areas with urban traffic noise of L_{dn} = 60 dB or higher, in contrast to only 16 million and 3.1 million people who live in areas with outdoor levels of L_{dn} = 60 dB or higher for aircraft and freeway noise, respectively. On the other hand, more people are exposed to higher levels of noise from freeway and aircraft operations than from urban traffic: about 300,000 people live in areas exposed to levels of L_{dn} = 80 dB or higher from freeway traffic; 200,000 from aircraft operations; and 100,000 from urban traffic. Bear in mind, however, that there may be differences between individual at-ear exposure levels and outdoor levels, because people move from place to place for varying amounts of time.

Relationship Between Indoor and Outdoor Levels

The contribution of outdoor noise to indoor noise levels is usually small. That part of a sound level within a building caused by an outdoor source obviously depends on the source's intensity and the sound level reduction afforded by the building. Although the sound level reduction provided by different buildings differs greatly, dwellings can be categorized into two broad classes—those built in warm climates and those built in cold climates. Further, the sound level reduction of a building is largely determined by whether its windows are open or closed. Table II shows typical sound level reductions for these categories of buildings and window conditions, as well as an approximate national average sound level reduction.

Table II
Typical Sound Level Reductions of Buildings

	Windows Opened	Windows Closed
Warm Climate	12 dB	24 dB
Cold Climate	17 dB	27 dB
Approximate National Average	15 dB	25 dB

Sample measurements of outdoor and indoor noise levels during 24-hour periods are depicted in Figure 7. Despite the sound level reduction of buildings, indoor levels are often comparable to or higher than levels measured outside. Thus, indoor levels often are influenced primarily by internal noise sources such as appliances, radio and television, heating and ventilating equipment, and people. However, many outdoor noises may still annoy people in their homes more than indoor noises do. Indeed, people sometimes turn on indoor sources to mask the noise coming from outdoors.

An example of the range of hourly sound levels measured inside living areas in plotted for each hour of the day in Figure 8. The figure shows the median levels and the range of levels observed for 80% of the data. During late night hours the typical hourly sound level was approximately 36 dB. This level was probably dominated by outdoor noise. However, during the day, the hourly average levels ranged from about 40 to 70 dB, indicating the wide range of activities in which people engage.

INDIVIDUAL NOISE EXPOSURE PATTERNS

During a 24-hour period, people are exposed to a wide range of noises, including noise at home, work, school, places of recreation, shopping establishments, and while enroute to these or other locations. Clearly, no single exposure pattern can be typical of all people, or even of those people who follow a common life style. Figure 9 shows hypothetical exposure patterns for broad classes of people. From these levels and some assumptions about the hours spent at different daytime activities, 24-hour average sound levels can be estimated for factory and office workers, housewives, and preschool and school-age children. Estimates based on these assumptions are found in Table III.

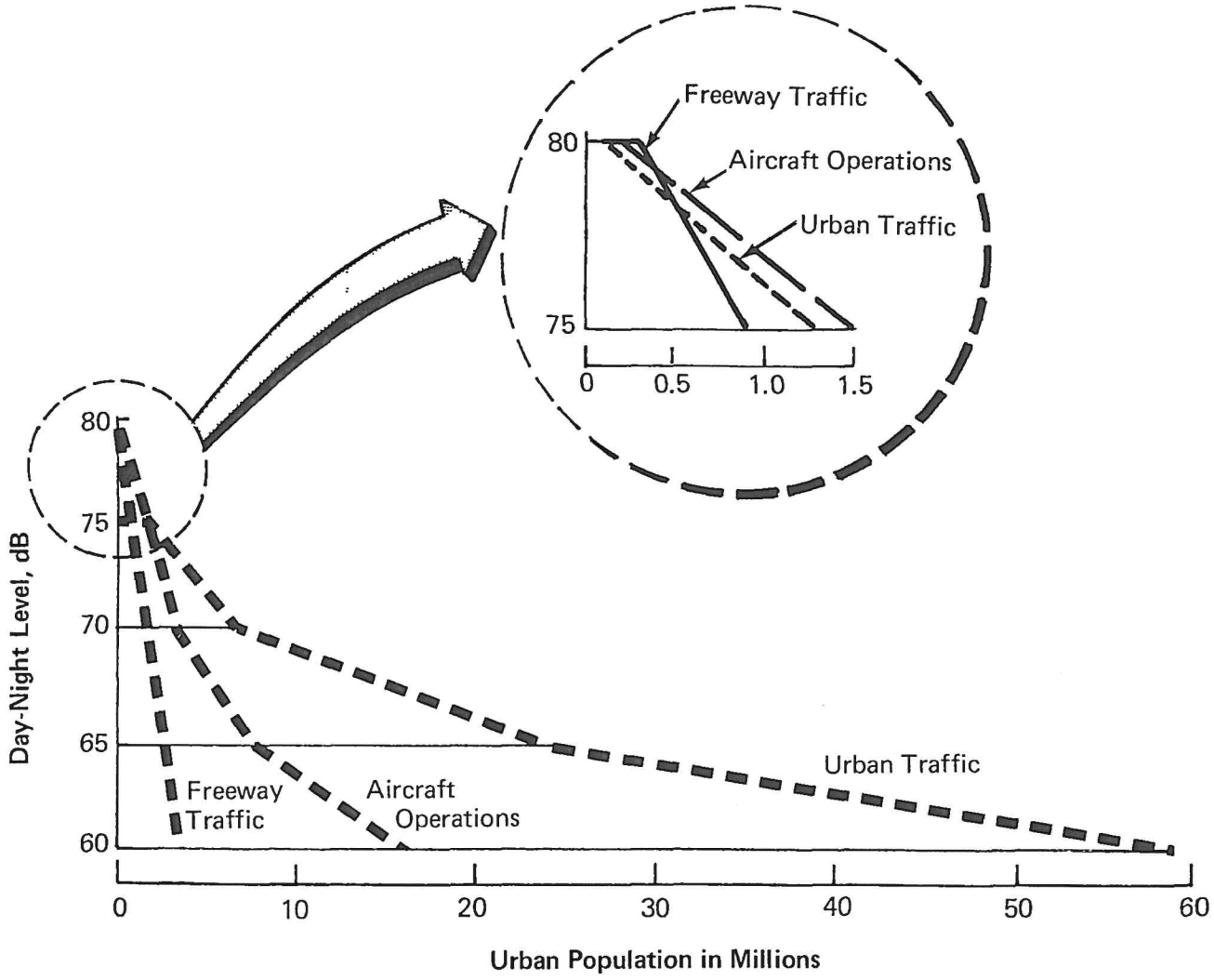

FIGURE 6. CUMULATIVE NUMBER OF PEOPLE IN URBAN AREAS EXPOSED TO OUTDOOR DAY-NIGHT AVERAGE SOUND LEVELS FROM DIFFERENT SOURCES

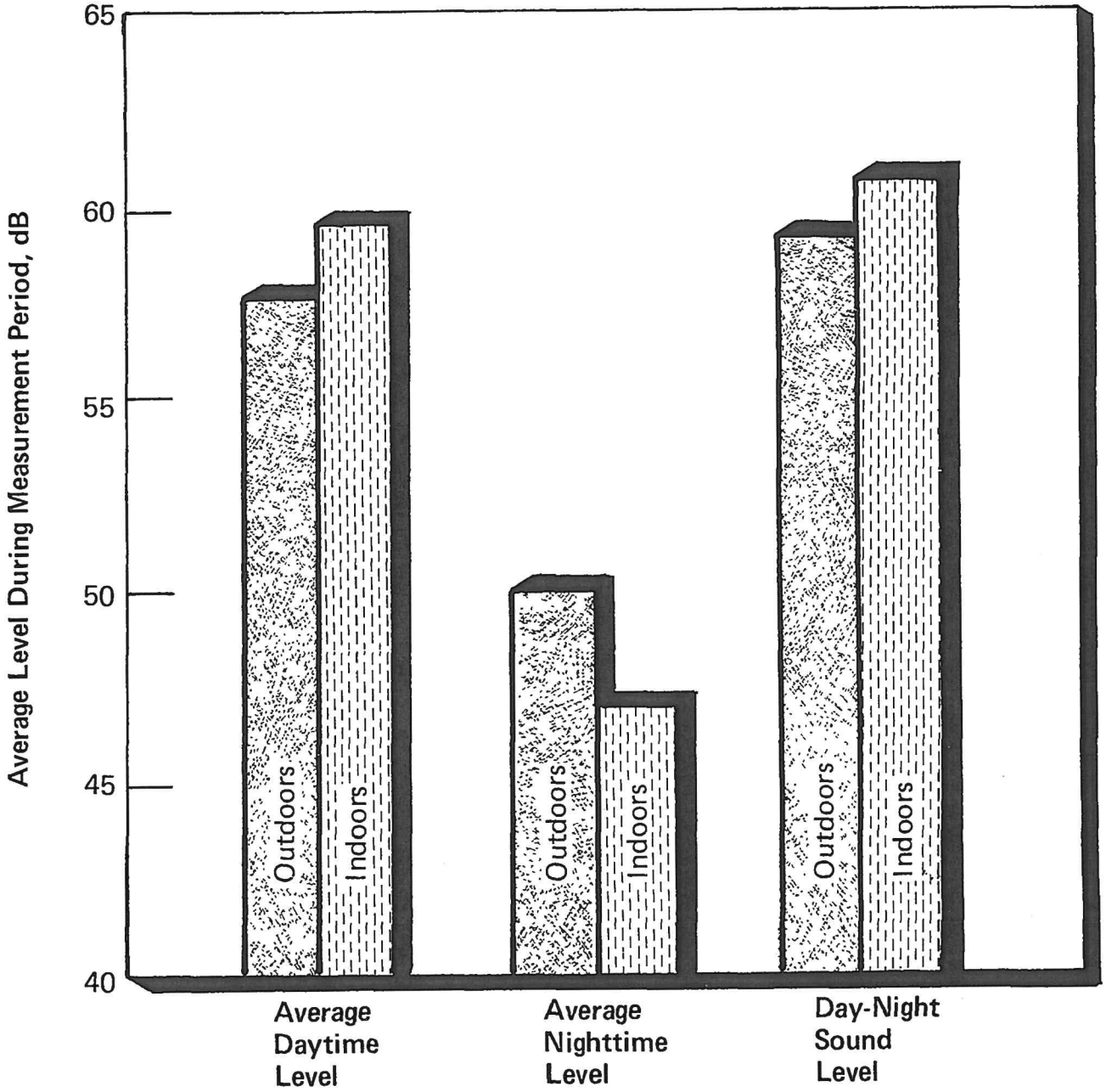

FIGURE 7. COMPARISON OF SAMPLE OUTDOOR AND INDOOR AVERAGE RESIDENTIAL SOUND LEVELS

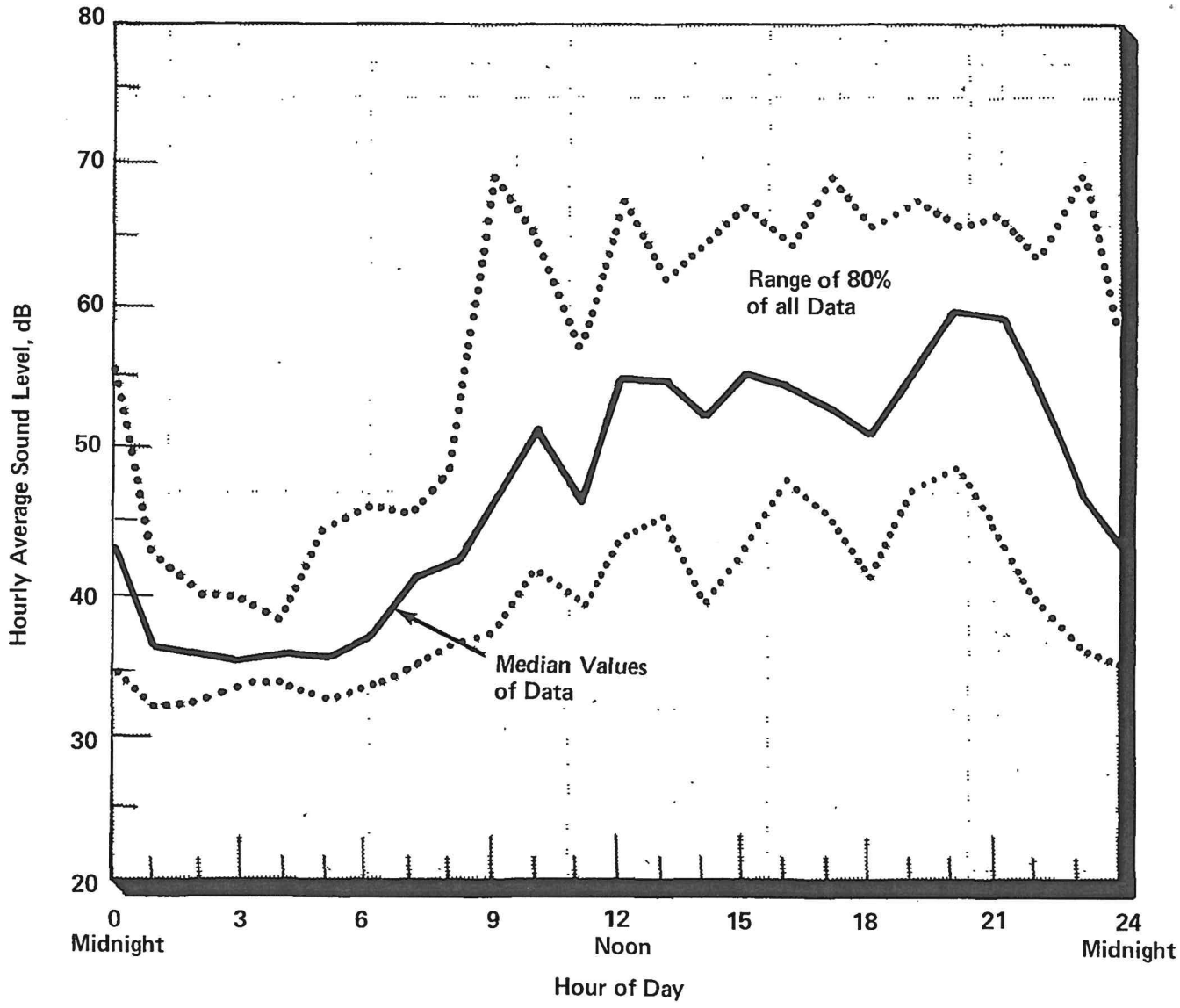

FIGURE 8. TIME PATTERN OF HOURLY INDOOR RESIDENTIAL SOUND LEVELS

For most people, nighttime noises do not contribute significantly to the 24-hour average. For many, the 24-hour average is determined primarily by the noise exposure of a single activity, frequently occurring for a short period of time.

Table III
Hypothetical Examples of Noise Exposures of Individuals

	24-Hour Average Sound Level, dB	
Individual	**Suburban Environment**	**Urban Environment**
Factory Worker	87	87
Office Worker	72	70
Housewife	64	67
School Child	77	77

HEARING DAMAGE FROM ENVIRONMENTAL NOISE

There is no question that exposure to certain levels of noise can damage hearing. However, determining exposure levels that protect hearing with an adequate margin of safety is a complicated matter.

This is because hearing is a complex ability that cannot be summarized by a single number in the way an individual's height or weight can be described. In fact, sizeable differences exist between individuals' hearing abilities. Hearing acuity tends to change progressively with age. Also, environmental noise exposure may vary considerably from moment to moment, so that specification of protective levels should include dynamic considerations. Further, relationships between hearing damage and noise exposure must be inferred, since available scientific information was gathered from groups of people who differed not only in noise exposure, but also in other important ways. Finally, individual and group noise exposures (especially over a working lifetime) are rarely known with precision.

In reaching conclusions about hearing loss, then, one must rely to a degree on assumptions, hypotheses, and extrapolations from existing data. Since complete agreement within the scientific community on these matters is lacking, an attempt was made in the Levels Document to consider alternative assumptions and hypotheses to ensure that the methods used to derive protective levels were based on the most defensible practice. As new data become available these levels may change slightly.

Basic Premises Involved in Determining Protective Levels

1. Changes in ability to hear in the region of 4000 Hz are the most important signs of irreversible hearing loss, indicating actual physiological destruction within the hearing mechanism. This frequency is usually the first frequency affected when the ear is damaged by exposure to noise. Furthermore, the protection of hearing acuity at this frequency is critical for understanding of speech and appreciation of music and other sounds.
2. Changes in individual hearing level, like changes in height or weight, are only significant if they are sizeable. Changes smaller than 5 dB are considered insignificant.
3. At all ages, it is assumed that hearing acuity cannot be damaged by sounds that cannot be heard. This may be important in that aging and other causes may produce appreciable shifts in hearing.
4. Because hearing ability varies from person to person, recommendations must be made in terms of a critical percentage of the population, ranked with superior hearing over the remainder. EPA's recommendations were based on the 96th percentile—that is, on providing protection for 96% of the people. It is assumed that people with poorer hearing than the 96th percentile are not affected by noise of typical levels (see 3 above), so that the recommendations protect virtually the entire population.
5. An individual's total noise exposure is evaluated by an "equal energy" rule: two noise exposures are expected to produce equal hearing loss if the product of exposure intensity and exposure time are equal. This rule allows a 3-dB decrease in sound pressure level (expressed in dB) for each doubling of the duration. Thus an exposure of 76 dB for one hour is equivalent to 73 dB for two hours, or 70 dB for four hours. This procedure is probably accurate for exposures of 30 minutes or more. It is also more protective for very short exposures and for noise that fluctuates greatly in level.

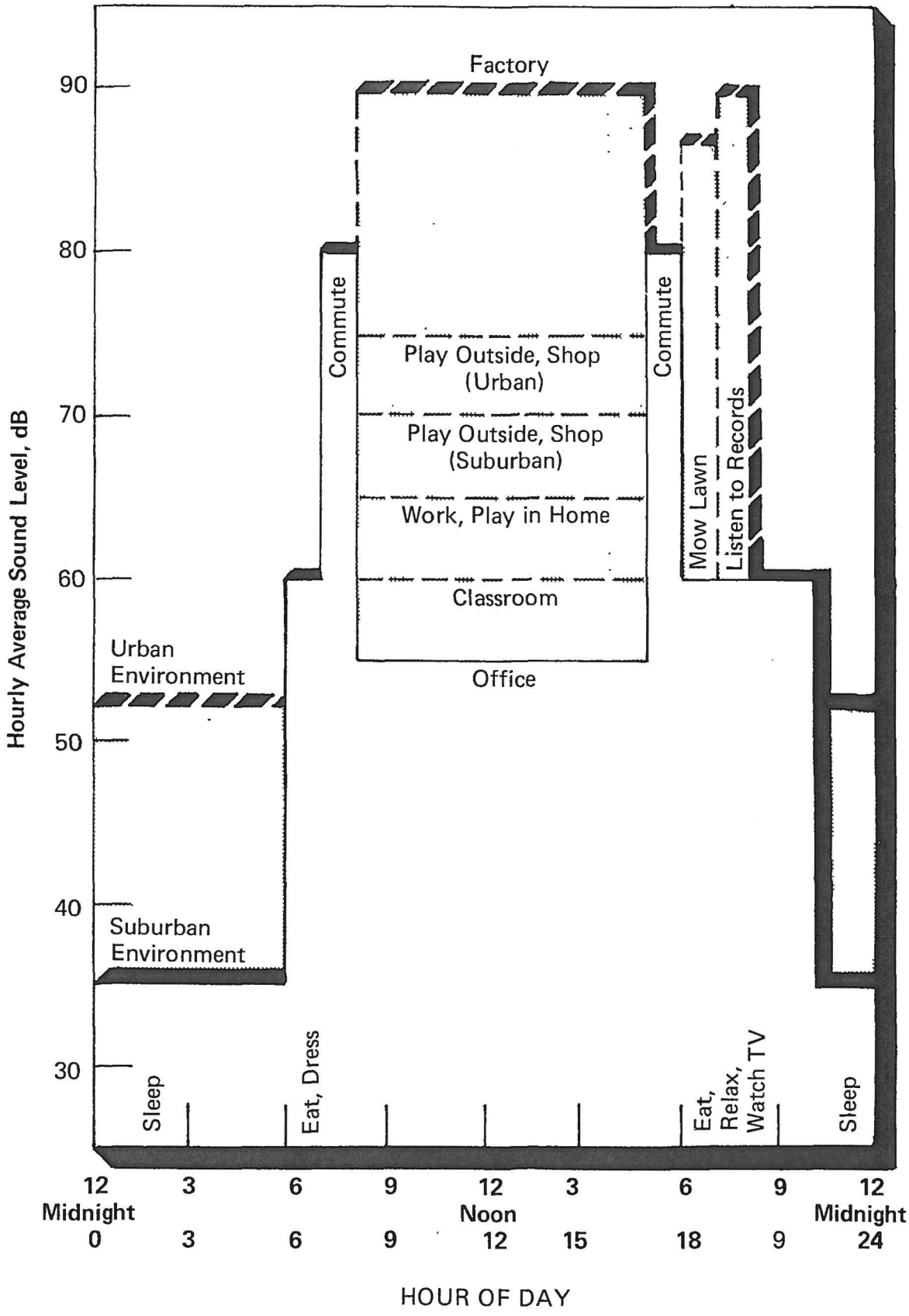

FIGURE 9. GENERALIZED INDIVIDUAL NOISE EXPOSURE PATTERNS

6. Intermittent noise produces less hearing damage than the "equal energy" rule would predict. To be considered intermittent for this purpose, a noise must fall below 65 dB for 10% of each hour and have peaks that exceed the background level by 5 to 15 dB. Intermittent noise is assumed to produce 5 dB less effect than does continuous noise of the same average level.

Calculation of the Maximum Allowable Noise Exposure

Three major scientific studies have attempted to assess hearing damage for various noise exposures. All are based on a comparison of groups of noise-exposed people and comparable non-exposed groups. All three studies attempted to predict hearing loss as a function of noise exposure of a certain percentage of people. Because these studies were of exposure to high-level noise, extrapolations of the data were necessary to estimate the protective exposure level that would produce minimal hearing loss: less than 5 dB at 4000 Hz for 96% of the people.

Forty years of exposure (250 working days per year) to a noise level of 73 dB for 8 hours per day was calculated to produce a hearing loss smaller than 5 dB for 96% of the people. This is the basic datum used to calculate hearing-protective levels of noise exposure. To use it in specific situations, certain corrections must be applied. One correction is to determine the yearly (rather than working day) level (250 to 365 days). This consideration amounts to a reduction 1.6 dB. Another correction, based on exposure on a 24-hour rather than 8-hour basis, produces an additional reduction of 5 dB.

Table IV contains at-ear noise exposure levels that produce negligible hearing losses for both 8-hour and 24-hour exposure on a yearly and working day basis. The 8-hour calculation assumes the remaining 16 hours of the day are spent in relative quiet.

Since an individual often experiences intense noise exposure outside of working hours (for example, while using noisy appliances or pursuing noisy recreation), protection on a 24-hour basis 365 days per year requires exposure of an intermittent variety at an equivalent level of less than 71.4 dB. This value is rounded to 70 dB to provide a slight margin of safety. Exposure to greater levels would produce more than 5 dB hearing loss in at least some of the population.

Table IV
(At-Ear) Exposure Levels that Produce No More Than
5 dB Noise-Induced Hearing Damage Over a 40-Year Period

		Steady (Continuous) Noise	Intermittent Noise	With Margin of Safety
L_{eq}, 8 hour	250 day/year	73	78	
	365 day/year	71.4	76.4	75
L_{eq}, 24 hour	250 day/year	68	73	
	365 day/year	66.4	71.4	70

Discussion of Assumptions

Several assumptions have been made in calculating the 24-hour yearly hearing-protective level of 70 dB. It is reasonable to ask how alternative assumptions would affect this level, and what the range of error might be.

Q. How would the recommended level be affected by a change in the percentage of the population protected?

A. Reducing the 96th percentile value to the 50th percentile (i.e., protecting half the population) would increase the protective level value from 70 dB to 77 dB.

Q. Since agreement on the value of the intermittency correction is imperfect, what other values might be used?

A. The estimated intermittency correction used in the Levels Document is 5 dB. The true intermittency correction is probably within the range 0 to 15 dB.

Q. *How accurate is the equal energy assumption?*

A. The equal energy assumption when applied to the long times (8 hours to 24, or 250 to 365 days) is fairly accurate. It may be subject to error when applied to short exposures of extreme level.

Q. How meaningful are the basic studies of hearing damage risk?

A. The probable errors of estimates in the three basic studies cannot be stated with absolute accuracy. There are a number of problems in extrapolating percentages of the population damaged from relatively high exposure levels to the protective level. Also, there is the problem of determining the amount of hearing damage when the control (non-exposed) population is subject to high levels of non-occupational noise. Thus, the 70 dB protective level is simply the best present estimate, subject to change if better data become available.

SPEECH COMMUNICATION

Communication is an essential element of human society, and speech is its most convenient form of expression. Interference with speech can degrade living directly, by disturbing normal social and work-related activities, and indirectly, by causing annoyance and stress. Sometimes the communications disturbed by noise are of vital importance, such as warning signals or cries for assistance. Prolonged speech interference and resulting annoyance are clearly not consistent with public health and welfare.

Speech interference from environmental noise can occur at home, at work, during recreation, inside vehicles, and in many other settings. Of chief concern for current purposes are the effects of noise on face-to-face conversations (indoors and outdoors), telephone conversations, and radio or television use.

The degree to which noise disturbs speech depends not only on physical factors (such as noise levels, vocal effort, distances between talkers and listeners, and room acoustics), but also on non-physical factors. The latter include the speaker's enunciation, the familiarity of the listener with the speaker's vocabulary and accent, the topic of conversation, the listener's motivation, and the hearing acuity of the listener. Years of research on speech intelligibility have produced considerable information about how these factors interact. Accurate predictions of speech intelligibility can be based on average noise levels and distances between speakers and listeners.

Speech Interference Indoors

The solid line in Figure 10 shows the effects of steady masking noise on sentence intelligibility for persons with normal hearing in a typical living room. At distances greater than about one meter from the speaker, the level of speech is fairly constant throughout the room.

The highest noise level that permits relaxed conversation with 100% sentence intelligibility throughout the room is 45 dB. People tend to raise their voices when the background noise exceeds 45-50 dB.

Speech Interference Outdoors

The sound level of speech outdoors decreases with increasing distance between speaker and listener. Table V shows distances between speaker and listener for satisfactory outdoor speech intelligibility at two levels of vocal effort in steady background noise levels.

The levels for normal and raised-voice "satisfactory conversation" shown in Table V permit sentence intelligibility of 95% at each distance. Ninety-five percent sentence intelligibility usually permits reliable communication because of the redundancy in normal conversation.

If the noise levels in Table V are exceeded, the speaker and listener must either move closer together or expect reduced intelligibility. For example, consider a conversation at normal vocal effort at a distance of three meters in a steady background noise of 56 dB. If the background level increases to 66 dB, the speakers either will have to move closer (to one meter apart) to maintain the same intelligibility, or alternatively, raise their voices appreciably. If they remain three meters apart without raising their voices, speech intelligibility would drop considerably.

Table V
Steady A-weighted Sound Levels That Allow Communication with
95 Percent Sentence Intelligibility Over Various Distances
Outdoors for Different Voice Levels

VOICE LEVEL	COMMUNICATION DISTANCE (meters)					
	0.5	1	2	3	4	5
Normal Voice (dB)	72	66	60	56	54	52
Raised Voice (dB)	78	72	66	62	60	58

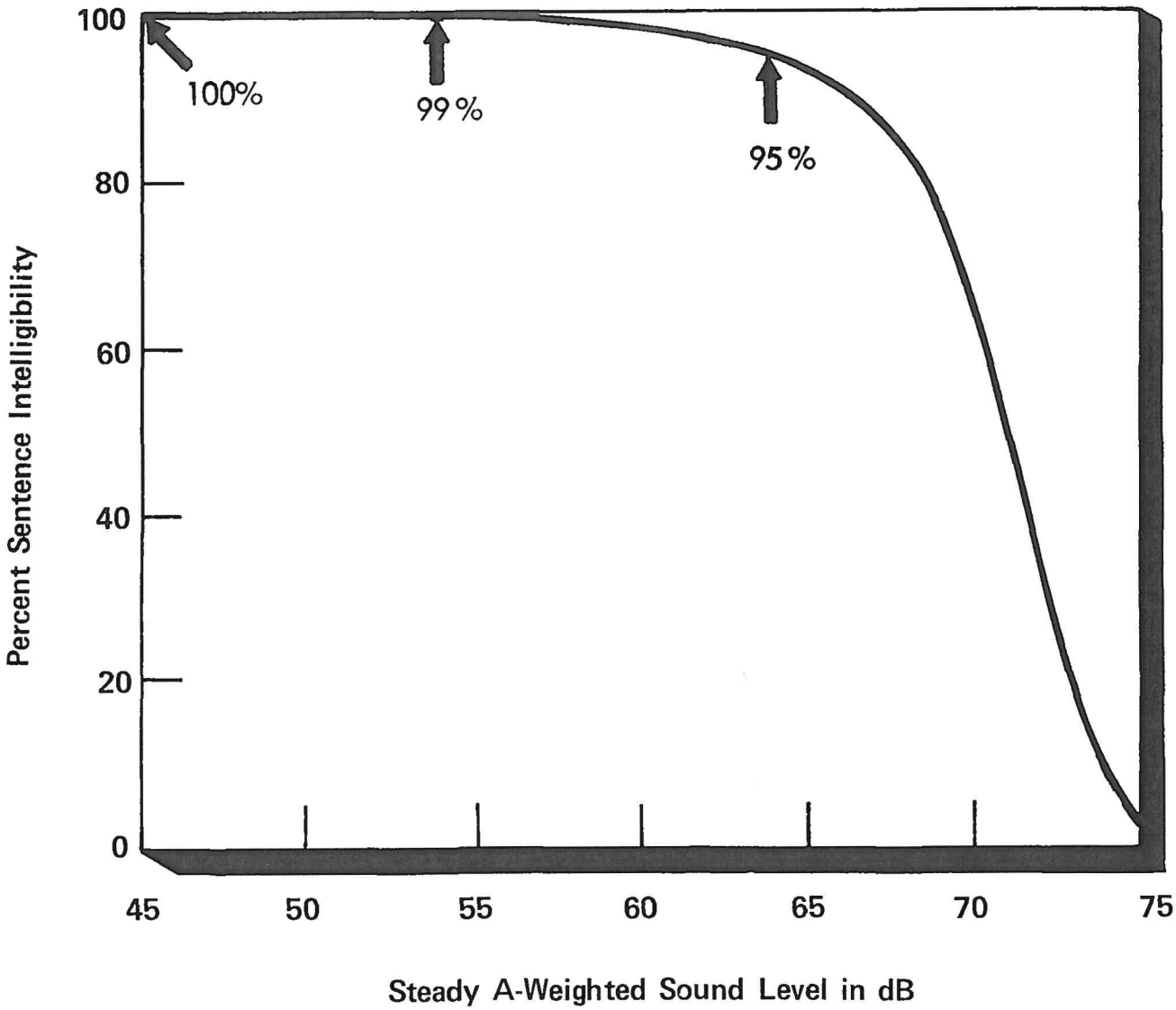

FIGURE 10. INDOOR SENTENCE INTELLIGIBILITY

Discussion

In summary, an L_{dn} of 45 dB permits virtually 100% intelligibility inside buildings. Assuming that a typical home reduces outdoor noise by 15 dB, the outdoor noise level should be no greater than L_{dn} = 60 dB to permit 100% intelligible speech indoors. Allowing a 5 dB margin of safety, the outdoor level should be L_{dn} = 55 dB. This outdoor level would also guarantee sentence intelligibility of 95% outdoors with normal voice levels at a distance of three meters.

Q. What do percentages of sentence intelligibility signify?

A. A given percentage of sentence intelligibility, such as 95% or 99%, indicates the proportion of key words (in a group of sentences) which are correctly heard by normal-hearing listeners.

Q. How are the speech criteria affected by the fact that people tend to raise their voices in noise?

A. The speech criteria are based on the principle that an adequate communication environment does not necessitate raised voices.

Q. How do the identified continuous equivalent levels relate to the fact that, in everyday life, noise fluctuates and is intermittent in nature?

A. The Levels Document tabulated speech interferences for different combinations of levels and durations to test the limits of certain L_{eq} values under intermittent conditions. It is acknowledged that, given equal L_{eq} values, fluctuating noise may reduce less total speech interference than continuous noise on average. On the other hand, during those times when the higher level noises occur, the speech interference will be greater than its average value.

ACTIVITY INTERFERENCE AND ANNOYANCE

Noise interferes with human activities to varying degrees. Intruding noises can interfere with human activities by distracting attention and by making activities more difficult to perform, especially when concentration is needed. Interference from noise can even make some activities (such as communication or sleep) virtually impossible. Except in the case of speech interference, however, the degree of interference is hard to specify and difficult to relate to the level of noise exposure.

Because people's reactions to time-varying noise differ from moment to moment, and because people's reactions differ in general, protective levels for annoyance and activity interference are determined from data collected from groups of people, rather than from individuals. Fortunately, considerable data from social surveys of community reactions to noise exposure are available for this purpose. Although there are some shortcomings in practically all such data, sufficient agreement exists to allow confident predictions of the noise levels that lead to certain degrees of activity interference and annoyance.

Activity Interference

Social surveys most often have been used to assess community reaction to noise exposure around airports. Table VI shows the percentage of people who reported noise interference with activities among a larger group which was extremely disturbed by aircraft noise.

It is hardly surprising that four of the nine activities in Table VI involve listening. Aircraft noise may also be found annoying because it may startle people, cause houses to shake, or elicit fear of a crash.

Another widely studied source of community noise exposure is vehicular traffic. Activity interference produced by traffic noise closely resembles that of aircraft noise, since interference with conversation, radio, television, and telephone use are all high on the list of activities disturbed.

Table VI
Percentage of Those People Who Were Highly Disturbed by Aircraft Noise, by Activity Disturbed

ACTIVITY	PERCENT
TV-Radio Reception	20.6
Conversation	14.5
Telephone	13.8
Relaxing Outside	12.5
Relaxing Inside	10.7
Listening to Records/Tapes	9.1
Sleep	7.7
Reading	6.3
Eating	3.5

Community Reactions to Noise

Two major indices of the cumulative effects of environmental noise on people are (A) specific actions taken by individuals or groups (such as complaints), and (B) responses to social survey questionnaires. Over the last 25 years, numerous studies have been conducted to increase understanding of the relationship between noise exposure and its effects on people in communities.

Several factors beyond the magnitude of exposure have been found to influence community reaction. These factors include:

1. Duration of intruding noises and frequency of occurrence
2. Time of year (windows open or closed)
3. Time of day of noise exposure
4. Outdoor noise level in community when intruding noises are not present
5. History of prior exposure to the noise source
6. Attitude toward the noise source
7. Presence of pure tones or impulses.

Since each of these factors may affect community reactions to noise exposure, adjustments for each have been developed to improve the predictability of community reactions beyond that available from a simple measure of exposure level. Figure 11 shows the results of several different case studies, relating L_{dn} (in dB) to community response with various correction factors added. The addition of the correction factors makes it possible to predict community reaction to within $\pm$ 5 dB. As is common with annoyance and interference caused by noise, the effects of context and situation may be almost as important as the magnitude or intensity of the source. Caution is also needed in applying these relationships to communities that are significantly quieter than average urban areas.

Social Surveys

Extensive social surveys have been conducted around Heathrow Airport near London and at eight major airports in the United States. The relationship found in these surveys between noise exposure levels and the percentage of respondents who were considered annoyed by noise is summarized in Figure 12.

Discussion

Q. Is annoyance simply a "welfare" effect?

A. Annoyance is a reflection of adverse effects which cannot be ascribed solely to "health" or "welfare." "Public health and welfare" in the context of the Noise Control Act is an indivisible term; there are no separate "health" effects or "welfare" effects. "Public health and welfare" includes personal comfort and well-being, and the absence of mental anguish, disturbances and annoyance as well as the absence of clinical symptoms such as hearing loss or demonstrable physiological injury.

Q. What is annoyance due to noise?

A. Noise annoyance may be viewed as any negative subjective reaction to noise on the part of an individual or group. It is not an indication of weakness or inability to cope with stress on the part of the annoyed. More likely it signifies transient (or possibly lasting) stress beyond the control of the conscious individual. This is often expressed on social surveys as the percentage of people who express differing degrees of disturbance or dissatisfaction due to the noisiness of their environments. For the purpose of identifying protective noise levels, annoyance is quantified by using the percentage of people who are annoyed by noise. This is felt to be the best estimate of the average general adverse response of people, and in turn, is viewed as reflecting activity interference and the overall desire for quiet.

Q. Are people annoyed at levels below an L_{dn} of 45 or 55 dB?

A. Individuals, or even groups, may be annoyed by noise at low levels—the dripping faucet or humming flourescent bulb are good examples. Annoyance depends very much on the situation, and on individual differences and noise durations.

Q. What do complaints represent?

A. Complaints are used by officials as an indication that a noise problem exists (although a noise problem may well exist in the absence of specific complaints). However, they do not necessarily represent the magnitude of a noise problem. The number of people who file complaints is only a very small percentage of those who are annoyed.

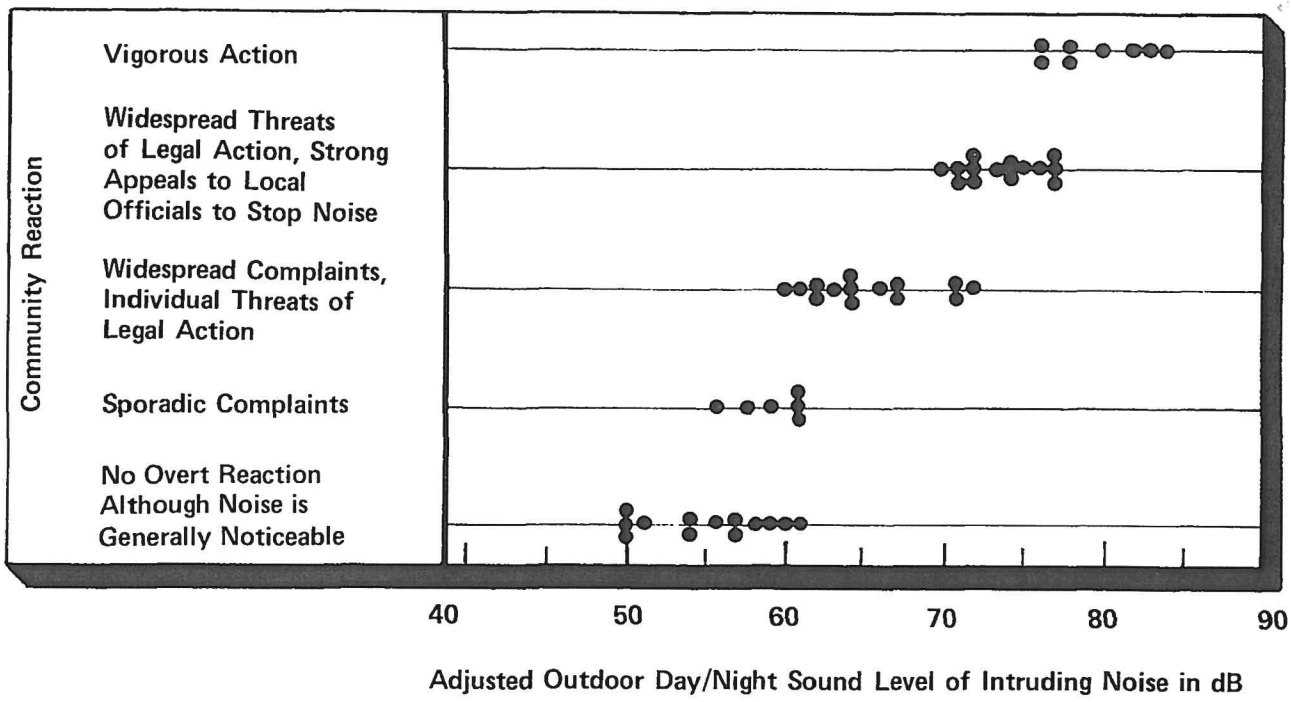

FIGURE 11. COMBINED DATA FROM COMMUNITY CASE STUDIES ADJUSTED FOR CONDITIONS OF EXPOSURE

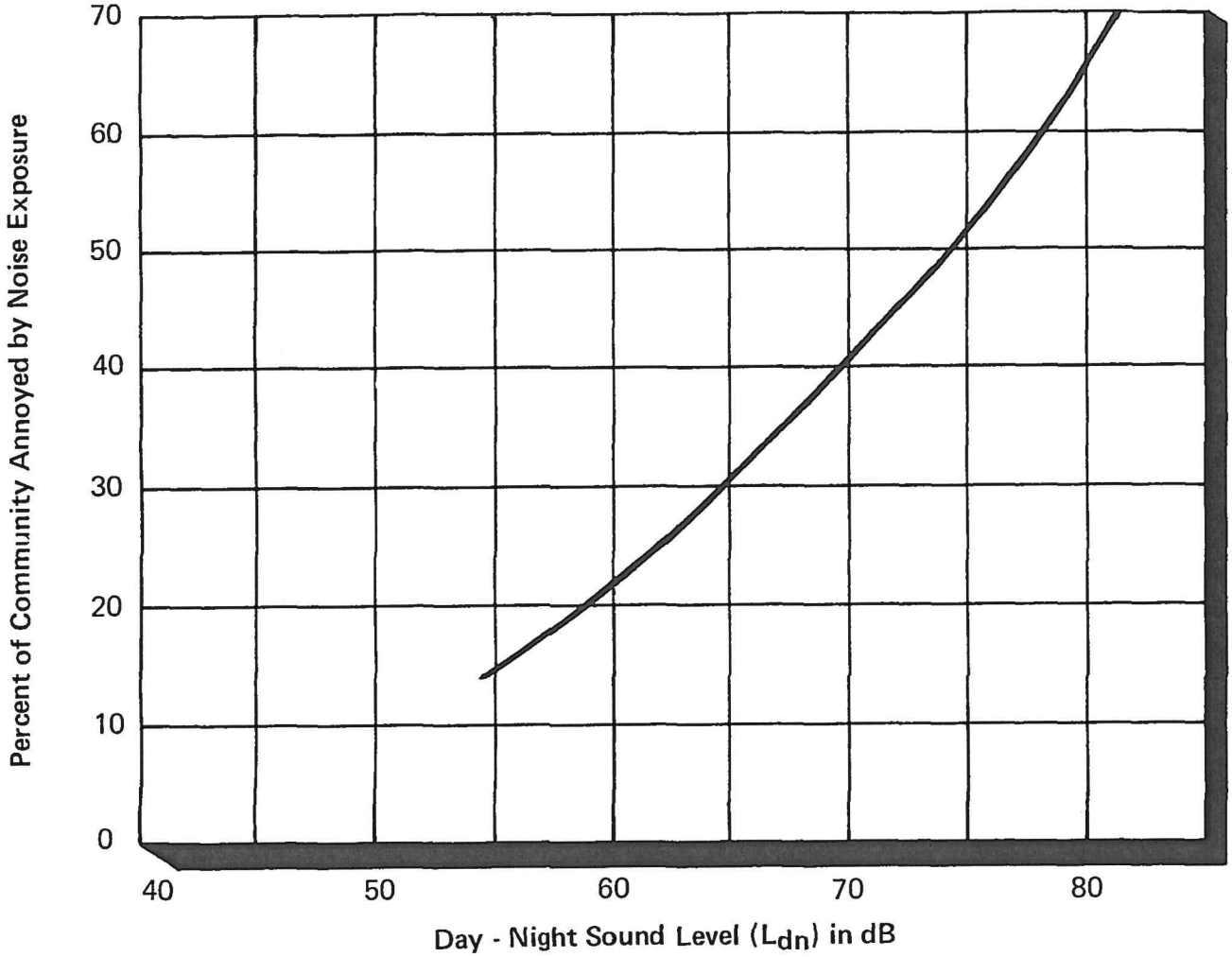

FIGURE 12. PERCENTAGE OF POPULATION ANNOYED BY COMMUNITY NOISE (HEATHROW AIRPORT STUDY)

Q. How is the margin of safety for annoyance applied?
A. The identified indoor level of L_{dn} = 45 incorporates a margin of safety for 100% protection of speech perception which is used as a surrogate for annoyance. The outdoor identified level of 55 L_{dn} protects speech outdoors to a level of 95% intelligibility at up to 2 meters, while incorporating a 5 dB margin of safety for speech, and giving added weight to the range of adverse effects.
Q. Why is the nighttime penalty 10 decibels?
A. The 10 dB nighttime weighting had two bases: first, this weighting value has been applied successfully here and in other countries; secondly, in quiet environments, the natural drop in level from day to night is about 10 dB.

SUMMARY

On the basis of its interpretation of available scientific information, EPA has identified a range of yearly Day-Night Sound Levels sufficient to protect public health and welfare from the effects of environmental noise. It is very important that these noise levels, summarized in Table VIII, not be misconstrued. Since the protective levels were derived without concern for technical or economic feasibility, and contain a margin of safety to insure their protective value, they must not be viewed as standards, criteria, regulations, or goals. Rather, they should be viewed as levels below which there is no reason to suspect that the general population will be at risk from any of the identified effects of noise.

Table VIII
Yearly L_{dn} Values That Protect Public Health and Welfare with a Margin of Safety

EFFECT	LEVEL	AREA
Hearing	$L_{eq(24)} \leq 70$ dB	All areas (at the ear)
Outdoor activity interference and annoyance	$L_{dn} \leq 55$ dB	Outdoors in residential areas and farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{eq(24)} \leq 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, etc.
Indoor activity interference and annoyance	$L_{dn} \leq 45$ dB	Indoor residential areas
	$L_{eq(24)} \leq 45$ dB	Other indoor areas with human activities such as schools, etc.

Outdoor yearly levels on the L_{dn} scale are sufficient to protect public health and welfare if they do not exceed 55 dB in sensitive areas (residences, schools, and hospitals). Inside buildings, yearly levels on the L_{dn} scale are sufficient to protect public health and welfare if they do not exceed 45 dB. Maintaining 55 L_{dn} outdoors should ensure adequate protection for indoor living. To protect against hearing damage, one's 24-hour noise exposure at the ear should not exceed 70 dB.

MISUSES, MISUNDERSTANDINGS, AND QUESTIONS

Perhaps the most fundamental misuse of the Levels Document is treatment of the identified levels as regulatory goals. They are *not* regulatory goals; they are levels defined by a negotiated scientific consensus. These levels were developed without concern for economic and technological feasibility, are intentionally conservative to protect the most sensitive portion of the American population, and include an additional margin of safety. In short, the levels in Table VIII are neither more nor less than what Congress re-

quired them to be: levels of environmental noise requisite to protect the public health and welfare with an adequate margin of safety.

Q. Why doesn't the Levels Document explicity say how much noise is too much noise?

A. Decisions about how much noise is too much noise for whom, for how long, and under what conditions demand consideration of economic, political, and technological matters far beyond the intent of the Levels Document. Such decisions are properly embodied in formal regulations, not informational publications such as the Levels Document.

Q. How do I use this information for local purposes?

A. This question reflects the need to reconcile local economic and political realities with scientific information. People who formulate local noise abatement programs cannot escape the responsibility of making such economic and political compromises for their constituencies. The Levels Document does not impose arbitrary Federal decisions about the appropriateness of noise environments upon any level of government, nor is it a source of prescriptions for solving local noise problems. It is best viewed as a technical aid to local decision makers who seek to balance scientific information about effects of noise on people with other considerations, such as cost and technical feasibility.

Q. If the identified noise levels are indeed sufficient to protect public health and welfare, shouldn't they be considered to be long-range regulatory goals?

A. Attainment of the identified levels of environmental noise can only be considered idealized goals. Pragmatically, it is unlikely that local, state, or Federal regulatory strategies will seek to attain such levels for all situations in the near future.

Q. Why isn't the Levels Document more definite about specific effects associated with various noise exposure conditions?

A. Available knowledge about the effects of noise would not support more precise statements. Increasingly specific statements will be incorporated in future informational publications as they are justified by increasing knowledge of human response to noise exposure.

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15. SUPPLEMENTARY NOTES

16. ABSTRACT

This publication is intended to promote understanding of EPA's findings about levels of environmental noise that protect public health and welfare. It seeks to clarify the proper use of the 1974 "Levels Document" by interpreting its contents in less technical terms. The manual deals with measurement descriptors of environmental noise. Also addressed are the best understood effects of noise on people (hearing damage, speech interference and annoyance). Protective levels are summarized.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Environmental noise levels, indoor and outdoor levels, measurement descriptors, noise exposure patterns, hearing damage, speech interference, annoyance, protective noise exposures		

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